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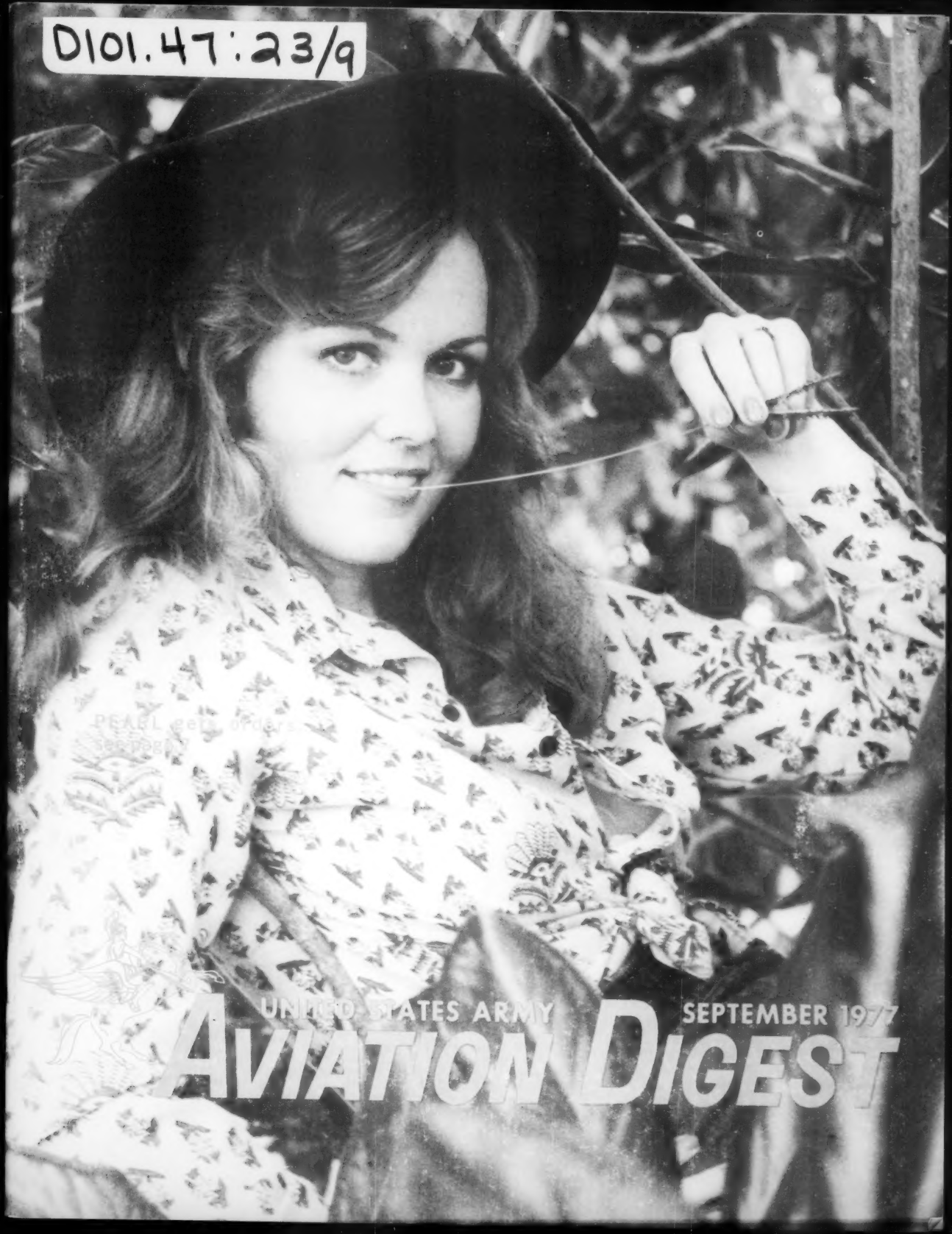

UNITED STATES ARMY SEPTEMBER 1977

AVIATION DIGEST

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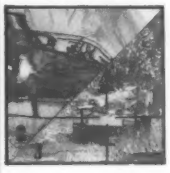
SEPTEMBER 1977 VOLUME 23 NUMBER 9

TRADOC System Manager Offices Established For Attack And Scout Helicopters 1
TOW Cobra — The School Solution, CPT Raymond P. Mulcahy 2
TOW Cobra — Gunner Training Devices, CW3 William A. Yarlett 3
Don't Feed the Bear, CPT Roger E. McCauley 4
So You Wanna Fly With A Headcold, Leon Dixon 6
PCS Orders for PEARL 7
A Lesson To Relearn?, Joseph B. Fries 10
Communications: A Matter Of Survival, CPT Barry Schiff 14
Army Aviation Center At A Glance, IV 24
EPMS Corner: Promotion, SFC W.E. Trotman 26
OPMS Corner: Personnel — ACIA — Astronauts MAJ Thomas M. Walker 27
Why Inadvertent IMC?, MAJ Michael E. Herndon 33
How Important Is The Right Symbol? 36
Follow The Leader, Arnold R. Lambert 39
How To Crash — By The Book 42
Where Do You Look For An Accident Prevention NCO?, SGM Wesley E. Toon 46
ATC Action Line 48
Rescue By 101st Aviators ....Inside Back Cover



MG James C. Smith
COMMANDER
U.S. ARMY AVIATION CENTER
A major activity of the
U.S. Army Training and Doctrine Command

COL Keith J. Rynott
COMMANDER
U.S. ARMY AGENCY FOR AVIATION SAFETY
A major activity of the
Inspector General and Auditor General
of the U.S. Army

Richard K. Tierney
EDITOR
U.S. ARMY AVIATION DIGEST

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TRADOC System Manager Offices Established For Attack And Scout Helicopters

ON 1 JULY 1977 two new Training and Doctrine Command (TRADOC) System Manager (TSM) offices were established under the commander, U.S. Army Aviation Center at Ft. Rucker, AL. The Attack Helicopter TSM Office is headed by Colonel John (Doc) Bahnsen and the Scout Helicopter TSM Office is led by Colonel George Shallcross. Both are Armor officers and Master Army Aviators.

Team members in the two offices are shown in figure 1.

The TSM offices are chartered by the commander, TRADOC. The goal of the TSM program is to ensure that from the user's point of view each vehicle is considered as a total weapons system early in the development

Continued on page 28

Figure 1

TSM
Attack Helicopter

COL Bahnsen

Training	Personnel	Logistics
LTC Moffett	MAJ Hipp	CPT Beach

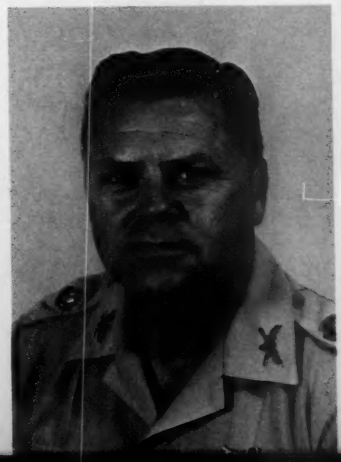
Address Attack TSM
U.S. Army Aviation Center
Bldg 503
ATTN: ATZQ-TSM-A
Ft. Rucker, AL 36362
AUTOVON: 558-5171/2108/3908

TSM
Scout Helicopter

COL Shallcross

Training	Personnel	Logistics
LTC Moeller	MAJ Pierce	MAJ Mancuso

Address Scout TSM
U.S. Army Aviation Center
Bldg 503
ATTN: ATZQ-TSM-S
Ft. Rucker, AL 36362
AUTOVON: 558-3808/4909



The TRADOC System Managers, Colonel John Bahnsen (left) and Colonel George Shallcross (right)

TOW Cobra – The School Solution

This article intends to give units receiving TOWs an idea of what training is done at the Aviation Center. It shares the combined experiences of more than a year's use of the system by the instructor pilots at Fort Rucker and hopefully provides some stimulation toward thinking about the sometimes very difficult task of target acquisition on the mid-intensity battlefield. It is hoped that field units will use this knowledge as a foundation for further training, integrating the Cobra TOW crew with scout elements and the remainder of the combined arms team in the tactical situations we are likely to encounter on the mid-intensity battlefield

SO YOUR UNIT is getting Cobra TOWs?* Wonder what kind of training you'll need to be doing? Perhaps I can answer that question.

I've served as flight commander at the U.S. Army Aviation Center, Fort Rucker, AL, instructing TOW training for the past year. During this time the Center has graduated nearly 200 AH-1 HueyCobra TOW

Continued on page 19

* tube-launched, optically-tracked, wire-guided missiles

CPT Raymond P. Mulcahy
Department of Graduate Flight Training
Fort Rucker, AL

TOW Cobra – Gunner Training Devices

TOW gunner training devices have caused a great deal of command interest throughout Training and Doctrine Command, U.S. Army Europe, and Forces Command. They have a significant effect on the training and proficiency of all AH-1 Cobra/TOW gunners and crews. There has been much confusion concerning the application of these devices that this article can eliminate

THE OVERALL TRAINING objective of the U.S. Army is to prepare to win the first battle of the next war. Accomplishing this objective will in all likelihood depend upon a first shot kill capability against the enemy armor threat.

A major answer is the AH-1S HueyCobra helicopter which is capable of launching a first shot armor penetrating tube-launched, optically-tracked, wire-guided (TOW) missile. This AH-1S Cobra TOW aircraft is the primary delivery aircraft for this weapon in the field today.

Continued on page 29

CW3 William A. Yarlett
U. S. Army Aviation Board
Fort Rucker, AL

DON'T

feed the bear!

CPT Roger E. McCauley
Lawton, Oklahoma

BY NOW EVERYONE has noticed that there is a trend toward better communication.

Don't believe it?

Well, how do you explain all those cars with the extra antenna on the freeway? Everyone is aware of the citizen band (CB) radio craze. Whether you own a CB or not, you've heard that they can really help out in emergencies and aid the driver in determining what's ahead. These handy little radios even are used to provide better and faster service from business and public utility vehicles. Gettin' right down to it, they even can keep you from feedin' the bears! [Paying a fine for traveling over the posted speed limit].

Army aircraft radios have a lot in common with those hauled around in the dashboards of many cars. It's probably a good bet, though, that aviators who own CBs know more about them than the radios in their aircraft. Usually the only time you talk about aircraft radios is during a checkride when you're sure to be able to rattle off the wattage and nomenclature for everything in the console. The advice of the avionics officer usually is weathered and radios are off before crank. Still, you seldom talk to anyone about your aircraft radios except when the radios don't work.

It's a good idea to get to know your aircraft radios a little better. In a tactical environment, you must know the ways the radio can work both for and against you. Our FM (frequency modulated), UHF (ultra high frequency) and VHF (very high frequency) radios account for a great deal of aviation's responsiveness by providing simultaneous coordination, with many stations, in both the air-to-air and air-to-ground roles. These radios operate on a frequency band of 30.00 to 399.95 megahertz, which is nice-to-know information. But, it's important to note that this frequency band is completely susceptible to interference or exploitation by enemy electronic warfare. (This band also is triple the size of that used by U.S. maneuver battalions.) Operating on a line of sight basis between the transmitter and receiver, their average range is 50 miles. Average range is dependent on a number of variables: weather conditions; time of day; operating frequency; transmitter power; attitude and altitude of the aircraft – all affect just how far the transmission will carry.

Usually aviation assets closest to the enemy have the most powerful radios. However there is little we can do to vector this signal power, since the antenna from which these signals radiate are fixed along the airframe. There is no way to vary power output, so full power is used with each transmission whether it

is needed or not. In addition, transmissions cannot be remoted from the transmitter source which is located within the aircraft.

Many ground communication systems, on the other hand, have high-low power switches to vary power output. Long-wire directional antennas can orient the transmission signal toward the receiver station while reducing the chance of having the signal intercepted. Remoting equipment can be used to displace the ground-based transmitter from the transmission originator.

In the past few years aviation tactics have changed significantly due to the increased effectiveness of enemy air defense systems. Equally effective will be the enemy's ability to wage electronic warfare (EW). The impressive array of EW equipment and the number of trained EW personnel should leave little doubt that this weapon will be employed as part of the normal order of battle. We must recognize that radio electronic combat, the Soviet term for EW, will demand modification of aviation communication practices. Electronic warfare efforts will be made to discern our intentions and locate and attack our positions. To accomplish our mission we must operate effectively despite efforts to exploit or interrupt our communications.

Any diehard CB'er knows that communication is important. Communication on the battlefield is *mandatory*, but the trick is to reduce transmissions thus reducing the chance of exploitation. There are many ways by which this can be accomplished. Most important, detailed and workable procedures that reduce the use of the radio must be implemented. This includes detailed coordination with supported ground units. Steps should be taken to minimize traffic by taking to heart that solid bit of advice which tells us to think before we speak. The chances of having signals intercepted can be reduced when an obstacle is placed between you and the enemy force. Ideally a hill or ridgeline, even a treeline or a group of buildings will absorb or reflect your signals.

Important means of communicating that are often overlooked are alternatives to radio communication. A system that has proven workable and effective, when communicating close in, is the flash card matrix system. In the NOE (nap-of-the-earth) flight mode, or anywhere that aircraft are relatively close, commands easily can be relayed by flashing a letter, number or color which would relate to a matrix language established by the unit's standing operating procedure (SOP). Aircraft movements have been used for years to communicate intentions. With standardization to fit the unit's needs these movements could relay commands in the tactical environment. Pennants, smoke grenades, hand and arm signals, and lights all have a place in helping communicate without the use of that handy little button on your cyclic.

The key to reducing radio transmissions is to understand that *detailed prior planning and practicing* of communication discipline are necessary. Check your SOP. If it fails to incorporate ways to reduce radio transmissions, chances are your unit is on its way to becoming a positive radio electronic combat target on some future battlefield. Remember, it's not enough to have that SOP; it must be workable and practiced. Practice it as part of every tactical exercise. After all, you don't want to feed the bear, 10-4?

Editor's Note

As the author states in the article above, current radios not only lack the ability to vary power output, but also emit this power in an almost omnidirectional pattern. These and other deficiencies will be corrected by the introduction of the new Single Channel Ground and Airborne Radio System (SINCGARS). This new radio will operate in the 30 to 88 MHZ band integrating communication security (COMSEC) and electronic counter-countermeasures (ECCM) to provide a balanced system capable of countering a most sophisticated hostile electronic warfare threat.

The SINCGARS radios will demonstrate improved electronic counter-countermeasures to include fast and slow frequency hopping, receiver/transmitter steerable null antennas and other techniques to provide a significant reduction in electronic warfare vulnerability. Steerable null antennas minimize interference by generating and steering nulls in the direction of the interference source. These antennas also reduce transmission signal strength in the same nulled direction, therefore reducing the signal received at the intercept location. Frequency hopping over several different frequencies at fractions of a second will make enemy intercept extremely difficult, and will also preclude the likelihood of successful jamming.

Leon H. Dixon
Department of Undergraduate Flight Training
U. S. Army Aviation Center

PERHAPS AN experience I once had could change your mind. We were stationed at Fort Riley, KS, in a unit making preparation for overseas shipment. A ferry flight of nine aircraft was planned. We were to deliver our UH-1 Hueys to Sharp Army Depot, Stockton, CA.

The first day's flight was uneventful. We landed at El Paso, TX and rested. The next day's journey would take us through the mountain ranges to the west. That night my stick buddy had complained of a headcold. I thought very little about it at the time. We were both only a few months out of flight school and quite inexperienced.

At the airport the next day we were advised our position in the flight would be "tail-end charlie." The climb to altitude went well – first 5,500 feet, then slowly to 7,500 feet and finally at 9,500 feet we were clear of the mountains. My stuffy-headed stick buddy made no complaints.

After a while, flight lead advised us that we would be descending for landing. We were told about a forming cloud layer and that the only visible hole was closing rapidly. Well, we had had difficulty keeping up with the flight all day, so when they rolled it over to make it through the hole we were left behind.

After descending about 500 feet, the pilot began to make a rumble about his head. He said that his sinuses had pressure on them and he could not clear his ears. So, we leveled off. It seemed to help for the moment. However, the clouds were building rapidly and we had only 500 pounds of fuel remaining. We decided to attempt a farther descent to visual flight rules (VFR) below the clouds. After receiving clearance I began to descend. By this time (7,500 feet), my stick buddy had both hands on his head and was in severe pain. We leveled off again, hoping to relieve some of his suffering. He tried everything: swallowing, chewing gum, holding his nose and blowing, decongestant sprays – all to no avail.

I was now becoming consciously aware of our fuel state. Our only alternative was to initiate a slow descent. As we started down I could almost feel his pain. Bob was passing in and out of consciousness. At about 5,000 feet he passed out completely.

I was concerned with the possibility that the pilot might slump over the controls or bind the pedals. I called the crewchief on intercom and told him to pull the red handles on the pilot's seat and rotate it to the rear. There was no response. I repeated myself rather loudly, thinking the crewchief was asleep. There was still no response, so I looked around only to discover he had unplugged his headset and was viewing the exterior from the right side.

Fortunately the pilot did not collapse on the controls. We landed at the airport (field elevation about 4,200 feet) where an ambulance was waiting. The ambulance crew administered oxygen and smelling salts and my friend regained both color and consciousness. Examination revealed no permanent ear damage, and he was released from the hospital in 2 days. He was lucky, but what about you?

So now I'll ask you again, do you want to fly with a headcold?

USAAAVS Moving on to bigger things in this everchanging Army

PCS orders for PEARL

IN LATE 1966 we decided to take on the job of telling you everything you wanted to know – and probably some things you didn't – about aviation life support equipment.

With Vietnam came speedy development of new and much-needed survival gear and along with it an avalanche of questions on how to get it, wear it, maintain it, and use it. Since there was no single source for the field to turn to for answers – and realizing the safety payoff from the proper use of personal equipment – we created PEARL (an acronym for Personal Equipment and Rescue/Survival Lowdown) to be our chief adviser on all life support equipment matters.

After the name came the search for a model. We didn't have to look far. We put a flight suit on our editorial clerk, posed her with pen gun and flares, and scheduled release of our first PEARL copy for the February 1967 *DIGEST*.

Since then we have had seven PEARLs, clad in everything from boots to bikinis, on the receiving end of our invitation to "Ask PEARL." And ask you did ... and discuss, and suggest, and propose, and refer to, and quiz on everything from yesterday's ill-fitting APH-5 helmet and

PCS ORDERS FOR PEARL

Mary Windham
1967

Gayle Balkcom
1968

Judy Strickland
1968

Becky Deloney
1968

flammable cotton flight suit to today's SPH-4 and Nomex.

That's the way we wanted it ... because through this exchange lives were saved by the proper use of personal equipment ... and that's what PEARL is all about. Over the years, PEARL has become synonymous with aviation life support equipment, a reliable adviser and recognized authority. And that's the way she'll continue in her new assignment.

By mutual agreement she will PCS in October to the DARCOM Project Officer for Aviation Life Support Equipment, Mr. A.B.C. Davis. You'll still get PEARL's straight answers and delightful curves in the pages of the DIGEST ... in fact the same pages,

pearls

Pearl's good looks and her dress (or lack of it) inspired an occasional poetic effort.

TO PEARL

Briefly should you advertise
Safety togs for those fly guys,
Really, it's a cruel mirage
For such a lithesome fuselage
To lead an airman to react
Only to the nicely "stacked."
Why, PEARL Dear, are you so clad
In furs and helmets meant for Dad—
Symbol of a warm flight crew?
Arctic wolves could do this too.
Life preservers do their job,
But why must they your beauty rob?
Leather gloves on tender wrist—
Analogous to camel's kiss!
Is exploitation of sweet charms
Vital to our men at arms?
Your editor should cry "finis"
And put you back in your bikini.

—Stanley B. Demes
Fullerton, CA 92633

Pearl has come a long way since the days of fire resistant fatigues and the APH-5 helmet.

Barbara Lindstrand
1970

Wanda McLemore
1971-1974

Jan Schwab
1975-1977

Martha Wiggin
1969

46 and 47. Here she'll continue to answer all your questions on ALSE. Queries should be addressed to DARCOM, ATTN: DRCPO-ALSE/PEARL, P.O. Box 209, St. Louis, MO 63166, or call AUTOVON 698-3241/3291.

USAAAVS will stay in the ALSE business, sans PEARL, through FLIGHTFAX. We'll report to you regularly on the effectiveness of your ALSE from a safety standpoint. We will also publish and distribute PEARL's memoirs – a pamphlet titled "The Best of PEARL." Sure to be a bestseller, this booklet will combine under one cover all the still-pertinent info from 10 years of PEARL. We'll let you know in FLIGHTFAX when copies are available.

We wish PEARL well in her new assignment ... in her increasingly important role as the Army's chief adviser on ALSE. We are proud of all our PEARLs. Their contributions to safety have been considerable. And we look forward to future issues of the DIGEST displaying all those PEARL charms ... as one reader put it:

PEARL's wholesome looks
Make safety a duty.
We'll read your dry books,
But give us our beauty.

A Lesson To RELEARN?

This article presents the personal views of the author and does not necessarily represent the views of Department of Defense agencies

Joseph B. Fries
Project Officer, Directorate of Combat Developments
U.S. Army Air Defense School, Ft. Bliss, TX

DURING WORLD WAR II the British lost 15 Mosquito aircraft to the fires of British and American forces. They also lost dozens of Spitfires, Hurricanes and other aircraft to the same fires.

Army antiaircraft, in an 11-month period during World War II, destroyed 12 Army Air Forces aircraft which were violating the identification criteria. More recently, Egyptian air defense forces shot down 40 of their own aircraft during the 1973 Mideast War.

There are many more such war stories to provide lessons on the continuing need for better cooperation between aircraft and ground forces. Recent experiences between Army aviation and air defense artillery (ADA) indicate that these lessons may have to be relearned the hard way. The interface is generally weak, but of specific interest in this article is the fact that teamwork on electronic identification, friend or foe (IFF) matters has been poor during simulated combat in joint training exercises.

Aviators and air defense artillery will have enough problems (e.g., ZSU-23-4 and the MIG-23) during combat without the self-inflicted wound of improper IFF use. Here are two war stories drawn from joint exercises:

- In an exercise planning conference, a senior air defense artilleryman endorsed the "shoot-em-down-and-sort-em-on-the-ground" philosophy and a master Army aviator noted that the artilleryman had flown successfully for 15 years without using IFF. These attitudes seem to have carried over into the exercise itself. The exercise plan published *16* IFF mode/code combinations for combined air defense identification and air traffic control use at any one time. The ADA rules of engagement/hostile criteria established for Hawk Air Defense Missile System authorized engagement of any aircraft that was "incoming, *and* below x feet, *and* above y knots, *and* without proper electronic IFF response" Division AH-1 Huey Cobras frequently identified themselves as "hostile" to Hawk by simultaneously meeting *all four* hostile criteria. The result – a number of perfectly "legal" simulated engagements of Cobras by division-support Hawk. Had the Cobras used IFF, this would not have happened.
- Another exercise plan assigned low flying helicopters a certain IFF mode, with a requirement for frequent inflight code-change, for air defense identification. Virtually no Army aircraft complied with the rules which, in this case, were nearly impossible for aviators to implement. The air defense rules of engagement for Hawk authorized engagement of helicopters that were "in a multiple-aircraft formation, *and* not under flight plan, *and* not under FCC/FOC (Flight Coordination Center/Flight Operations Center) control, *and* without proper IFF response." Many of the division's helicopter formations and some "nonformations" that looked like formations on a radar scope, identified themselves as "hostile" to Hawk by simultaneously meeting *all four* hostile criteria. During the exercise, a senior Army aviator expressed no concern over nonuse of IFF by division aviators because "we fly so low you ADA people will never see us anyway." Hawk skin-tracked and performed simulated "legal" engagements on a number of these helicopters during that exercise. Had the helicopters used IFF, this would not have happened.

These examples are two among many that threaten Army helicopter survivability on the battlefield. They also illustrate a hazard to the health of aviators as well as a potential waste of scarce and expensive ammunition intended for use against the enemy.

The rest of this article presents one man's views for consideration by Army aviators. The views are unofficial, possibly biased, and perhaps do not

identify all the culprits. But the problem is real and the article is intended to get Army aviators thinking more about this serious and significant problem area.

Problem Causes. The potential for self-inflicted wounds seems to stem from several causes:

- Army aviation and ADA lack experience working together.
- Doctrine, service school instruction and unit training regarding dissemination and use of IFF instructions appear inadequate.
- Some in air defense artillery have the mistaken idea that they will only be worried about jet aircraft during combat.
- Some aviators are not aware that electronic IFF is a major part of the air defense rules of engagement. Furthermore, some are under the false impression that their flight tactics will always make them "unseen" to friendly air defense radars.
- Some do not distinguish the different environments for IFF use: civil ATC (air traffic control), exercise and combat.

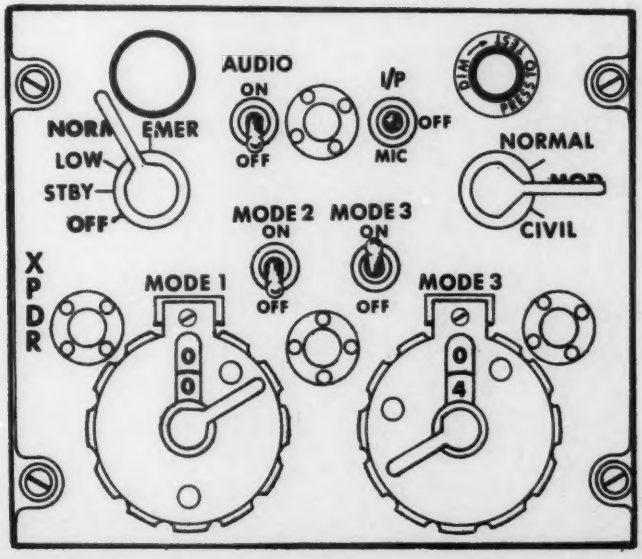
Environmental Differences. The IFF environment varies with the theater and the situation:

- *Civil ATC:* Army aircraft must fit into the civil ATC scheme when operating in and entering/departing that environment. Much of the electronic IFF capability is turned off, unless a request for turn-on is received from an air traffic controller. Codes may be changed inflight as necessary to enhance air traffic control service. Misuse of IFF rarely imposes a severe penalty.
- *Exercises:* Exercises take place in a mixed civil ATC-combat environment. Division aviation may not use formal ATC services in the exercise area and aviators may therefore not be motivated to turn on their IFF and check code settings. Or, maybe they do not get the word. This has been the case in most exercises the past few years. Failure to use IFF would cause no great problem if it were not for the requirement to train for air defense-aviation teamwork in as realistic an environment as possible. Aviator misuse or nonuse of IFF degrades the Air Defense force's ability to ident aircraft. Nonlethal mistakes then accumulate. Aviators rarely find out that they caused themselves to be "killed" by their own ADA 2 minutes into exercise D-Day.
- *Combat:* In combat, most of the IFF capability must be turned on; codes must be changed frequently on a rigid area-wide schedule; and the ATC function is not permitted to interfere with the use of IFF that provides identification to other friendly weapons. The price of IFF misuse may be high if we do not learn to use IFF equipment.

Equipment. The IFF system consists of transponders and interrogators:

- *Transponders:* The airborne element of the electronic IFF system has the task of receiving a coded question and then sending a coded answer.

APX-44



The answer to air traffic controllers often contains aircraft and flight details further augmented by ground-air-ground voice contact. The Army air defense forces do not use ground-air-ground voice links and only are concerned with the aircraft's friendly or hostile character.

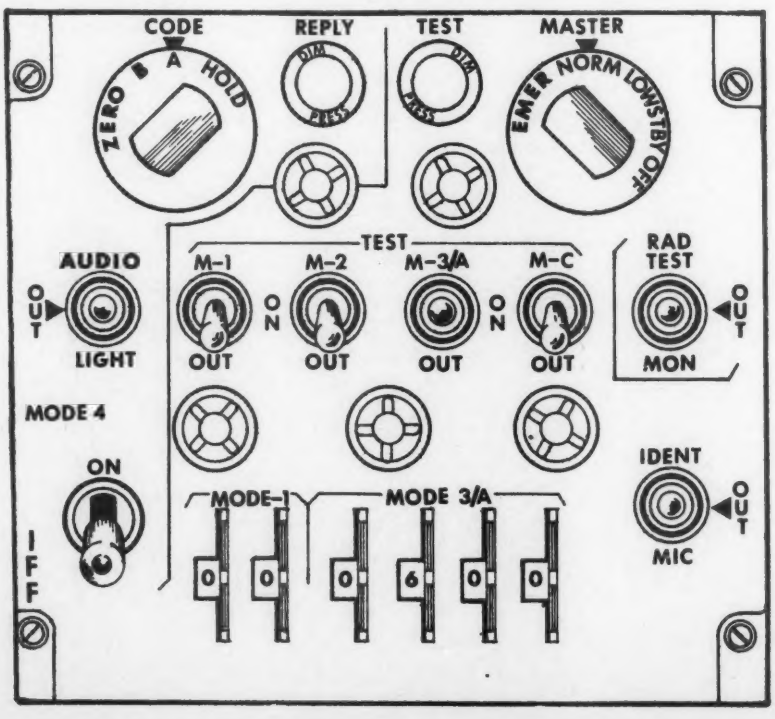
• *Interrogators:* Interrogators ask the question: Are you a friend? Air defense primary radars and air defense aircraft have IFF interrogators (the interrogators are often called "secondary radars"). Future visually directed Army air defense artillery systems, e.g., the shoulder-fired Stinger, also will have an IFF interrogation capability to augment visual identification.

Modes And Codes. The system of transponders and interrogators uses various mode/code combinations to complete the question-answer cycle for aviators, ATC and air defense. The mode/code combinations are bulk allocated at or above the joint force level and translated into specific rules and lists at the air defense commander/airspace manager (normally the Air Force commander) level. The necessary information is then provided to all users. The Army is responsible for internal dissemination of procedural and code list information. Four IFF modes, each with changeable codes, are the key to the successful interface of aviation and air defense forces. All four modes may be *on* simultaneously.

• *Mode 1:* Transponder response to interrogations in this mode provides part of an aircraft's "signature." In peacetime the Mode 1 code changes infrequently. In war the code in effect changes frequently on a rigid schedule. Changes are accomplished inflight. Mode 1 is normally *on* in peace or war (the Army aviator with an APX-44 transponder can turn Mode 1 *off* only by placing the entire transponder to the *off* or *standby* setting).

• *Mode 2:* This mode provides the remainder of the aircraft's unique signature. Each aircraft or aviation unit has its own Mode 2 code setting. Inflight Mode 2 code change is not required in peace or war. Unlike Mode 1, Mode 2 normally is turned *on* only when requested by a ground controller. Otherwise, Mode 2 if *off* in peace or war. This mode is not usually of interest to the Army ADA forces in combat.

APX-72



• *Mode 3/A (Also called "3" or "A"):* To this point, IFF use is not greatly different in peacetime versus combat conditions. However, Mode 3/A usage is different (APX-72). In the civil ATC environment. Mode 3/A often is off; it is turned on and code changes made inflight as directed by ATC via ground-air-ground voice communications. Different blocks of codes may be assigned to different aircraft or functions in an area and used as necessary to aid in ATC. The combat concept is almost diametrically opposed to the civil ATC concept. In combat, Mode 3/A always is *on*, only *one* Mode 3/A code is set in and changed per an *area-wide* schedule and ATC usually is not authorized to order code change or Mode 3/A *turn-off*. This is because, in combat, identification for weapon control purposes takes priority over ATC usage. Mode 3/A becomes the primary means for an aircraft not equipped with Mode 4 to electronically identify itself as a "friend" to the various other weapons. An aircraft not responding properly in any of the modes employed for air defense identification during combat is in danger of destruction by friendly forces.

• *Mode 4:* Suitably equipped aircraft use Mode 4 as *the* way of securely identifying themselves electronically as "friend" to weapon controllers. Mode 4 comes close to providing "positive friend" identification. The aviator has an indicator light to tell him when he is being interrogated in this mode. ATC does not use the mode for purely ATC purposes. Codes are keyset while the aircraft is on the ground. Mode 4 normally is *on* in combat. Because not all aircraft are equipped with the Mode 4 capability, the air defense forces in combat continue to use Mode 3/A as the primary means of identifying nonmode 4 aircraft.

Suggested IFF Use. The IFF concept must be implemented by properly setting switches and dials in aircraft and on ADA weapons. Suggested rules are:

• *Exercises:* Rules for IFF use are, or should be, published in exercise directives. The most combat-like environment will be simulated in the exercise area by the mode/code use shown in the figure below. The figure applies to single aircraft flights, flight leaders and tailmen in strung-out formations. Differences from common civil ATC applications are underlined. Initial settings and self-tests should be part of the preflight checkout procedure.

• *Combat:* Rules for use of IFF during combat are published in each theater in classified directives. Such rules are much like the suggested exercise rules with the understanding that Mode 4 use for air defense identification purposes is stressed. Also, the joint commanders' combat rules may specify that the entire IFF transponder be turned to *standby* when over enemy territory *and* outside the range of friendly weapons. This reduces the possibility of enemy exploitation of the IFF radiations to the aviator's disadvantage. IFF turn-on occurs upon reentry, as described by the joint rules, because the need to identify oneself then takes precedence.

If Army ADA and Army aviation are to do their thing – to the enemy rather than to each other – they will have to understand the rules and play by them. One of the rules calls for aviators to obtain and use the IFF mode/code lists. They should not wait for a shooting war to practice this. Lessons relearned are expensive!

Aviator Control Setting	Preflight Initial Setting	Inflight Changes
Function Control (APX-44 only)	MOD	None
Master Control	NORM	None*
Mode Enable Switches		
Mode 1 (APX-72 only)	ON	None
Mode 2	OFF	As ATC requests
Mode 3/A	ON	None*
Mode 4	OFF**	None
Code Control Dials		
Mode 1	Code List	Only as part of exercise-wide change schedule
Mode 2 — no access inflight in most aircraft)	Code List (one-time assignment)	None
Mode 3/A	Code List	Only as part of exercise-wide change schedule

* Except actual inflight emergency requires use of EMER setting and, for APX-44 only, Mode 3 code 77

** Because of normal security requirements. May not apply in some cases

Communications
A Matter Of Survival

Barry Schiff
Trans World Airlines, Captain

Reprinted from the Aircraft Owners and Pilots Association (*AOPA*) *Pilot*

COMMUNICATION is the fundamental tool used by man to build an advancing society. Without it, there would not be antibiotics, footsteps on the moon, or supersonic flight.

It seems incongruous, therefore, that one of aviation's most pressing problems is the often unacceptable quality of this vital necessity. For despite the marvels of sophisticated ARTS III computer technology, the weakest link in the ATC chain is the interface between pilot and controller. Because they often communicate with confusing terminology and utilize variously misinterpreted procedures, this link can stretch to intolerable limits. Occasionally, it snaps.

The result is the type of accident that occurred on 1 December 1974, when TWA's Flight 514 was "cleared for an approach" to Runway 12 at Dulles International Airport near Washington, DC. The captain interpreted this to mean that it was safe to descend to the lowest altitude published prior to the final approach fix; the controller thought otherwise and a communications gap occurred. The resultant tragedy clearly demonstrated (according to NTSB) that a major cause of the accident was a lack of understanding between pilot and controller.

Although it may be self-serving to condemn the captain for having descended prematurely, it is worth noting that the approach clearance has been misunderstood by the aviation community for years.

In 1967, the Air Force requested clarification of "Cleared for the approach" as it pertains to terrain avoidance responsibility. In 1970, at least one major airline repeated the need for definition. A satisfactory answer was not provided.

FAA did respond, however, to the loss of 92 lives. A few months after the TWA accident, FAR Part 91 was revised to state, in essence, that when a pilot is cleared for an approach, he shall maintain the last assigned altitude until established on a published route at which time he may descend to the applicable published altitude.

Admittedly, no one has the foresight to devise procedures that anticipate all potential problems. Even if this were possible, the resultant body of law would be impractically voluminous. But when pilots wave a red flag and admit confusion regarding a specific procedure, someone in the bureaucratic hierarchy should have the common sense to pay attention. Similar misunderstandings between pilots and controllers cannot be tolerated.

One reason for the confusion is that controllers

GLOSSARY

ARTS	**Automated Radar Terminal System**
ATC	**air traffic control**
FAA	**Federal Aviation Administration**
FAR	**Federal Aviation Regulation**
IAF	**initial approach fix**
IFR	**instrument flight rules**
ILS	**instrument landing system**
MEA	**minimum enroute altitude**
MSA	**minimum sector altitude**
MVA	**minimum vectoring altitude**
NTSB	**National Transportation Safety Board**
STAR	**standard terminal arrival route**
TWA	**Trans World Airline**
VFR	**visual flight rules**
VHF	**very high frequency**
VOR	**VHF omnidirectional range**
VORTAC	**VHF omnidirectional range/tactical air navigation**

have a lexicon and a procedures manual that is not readily available to most pilots. Occasionally this creates an impossible situation and is like playing football with one rule book while the opposing team uses another. Pilots, however, have more than touchdowns at stake.

Even a supreme authority, the NTSB, contributes a confusion by misinterpreting certain terms. Two members of the board, for example, stated officially that the TWA accident would not have occurred, "if the pilot had maintained the minimum sector altitude (MSA) as depicted on the approach plate." This is true but erroneously implies that when a pilot is on a radar vector and is cleared for an approach, he should not descend below the MSA. Figure 1 helps to demonstrate why this is completely absurd.

The diagram is a simplified view of an ILS approach to Runway 25 at Ontario, CA. The aircraft is on a vector to the localizer at 3,000 feet. Prior to intercept, the pilot is cleared for the approach at which time he determines that the MSA for the north-easterly quadrant is 11,900 feet because of mountains north of his position. According to NTSB's implication, a pilot should not be below the MSA. Is he expected, therefore, to climb to 11,900 feet? Obviously not.

The MSA is an emergency altitude to be considered only when a pilot is unable to determine an applicable safe altitude due to radar or communications difficulties.

There are a host of other terms subject to misinterpretation. Take, for example, something as simple as a VFR, straight-out departure. Recently, a pilot requested and was cleared for a "straight-out." After tracking the extended runway centerline until well outside the traffic pattern (3 miles), the pilot turned right to proceed enroute. Shortly after turning, however, he had a near-miss with a helicopter.

A violation was filed against the pilot because he failed to make a straight-out departure from the airport traffic area, which has a 5-mile radius. The pilot ultimately got off the hook because the FAA did not have an official definition for a straight-out departure.

There are a number of terms taken for granted that have no official status in modern, ATC jargon.

Parenthetically, the TWA accident probably would not have occurred were it not for something else that most pilots take for granted – the radar vector. Had the captain been allowed to navigate by following published routes, he never would have been in doubt as to the minimum enroute altitude for any portion of his flight. MEAs are printed plainly for all to see.

Radar vectors ars usually accepted graciously by most pilots because these presumably simplify navigation and allow additional time to prepare for an impending IFR approach. But some pilots are beginning to regard radar vectors with mixed emotions. By accepting a vector, navigation and terrain clearance responsibility shifts from the cockpit to the controller. For a variety of reasons, this can result in disaster – aircraft have been vectored into mountains.

Once an aircraft is removed from a published route by a controller, it is often difficult for the pilot to determine applicable minimum safe al-

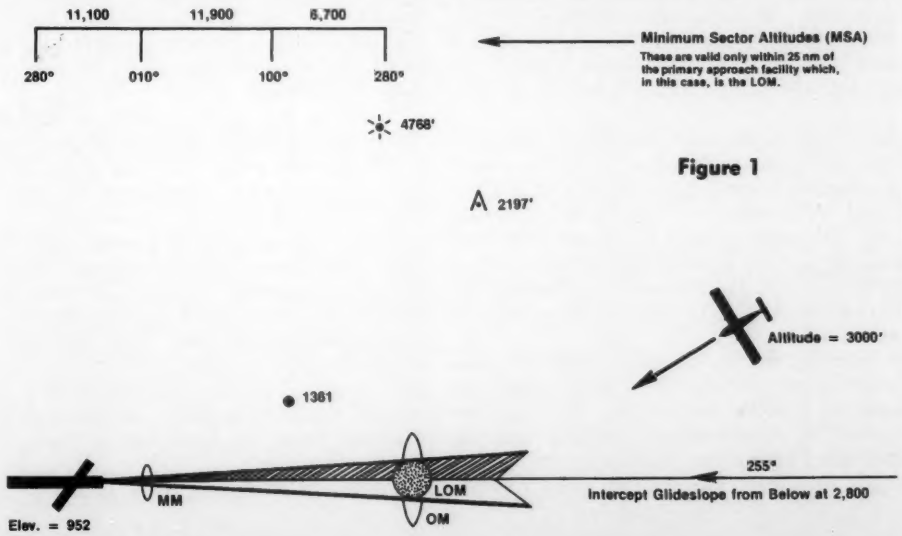


Figure 1

titudes, especially when over mountainous terrain. For this reason, some pilots attempt to refuse radar vectors. Depending on traffic volume such a request is frequently honored. At other times, the confines of a holding pattern may be the undesirable alternative, but at least this affords a pilot the peace of mind of knowing precisely where he is at all times.

It can be discomforting to be vectored toward rising real estate. So rather than worry about being forgotten by the controller (it happens), don't hesitate to ask how long you can expect to be on the vector. In this way, a pilot has a form of "clearance limit" at which point he can ask for a new heading or, in case of a frequency jam and an urgent need, he can turn toward lower terrain (with or without permission).

Relinquishing navigational responsibility to a controller is one thing, but allowing him to crawl into the cockpit and fly the airplane is quite another. At airports surrounded by noise-sensitive neighbors, for example, it is not unusual to hear a tower controller advising a pilot to use the "maximum rate-of-climb for noise abatement purposes." Such a "clearance" is irritating because a traffic controller does not have the right to dictate flight technique especially when using the wrong terminology, as in this case.

The controller would like the aircraft to be as high as possible above neighboring homes during the climb. But as every pilot knows, it is the best angle-of-climb that produces this result, not the best rate-of-climb. Instructing a pilot, especially a student, to climb at the maximum angle can result in tragedy. The salient point is that the pilot-in-command knows best how to fly his aircraft at any given time; he should not relinquish command authority to someone on the ground who is unfamiliar with both the experience level of the pilot and the operating paramenters of the aircraft.

Conflicts also arise because IFR charts are sometimes misleading. An air carrier, for example, was recently cleared for a Judds One Arrival to Bradley International Airport at Windsor Locks, CT. The captain used the STAR chart and navigated toward the Bristol Intersection (an initial approach fix on the localizer for Runway 6). Prior to reaching IAF, ATC cleared the aircraft to "hold at Bristol."

Upon reaching the fix, the pilot entered a standard, right-hand pattern. But after the plane completed the first 180-degree turn, the controller transmitted an emergency clearance and admonished the captain for holding on the wrong side of the localizer. The puzzled crew double-checked the STAR and approach charts; there was no published pattern to indicate the use of a nonstandard left-hand pattern. After the dust had settled, the controller advised that the enroute chart displayed a left-hand pattern. The pilots, however, were using a STAR chart (as they should) that did not (and still doesn't) contain this vital information.

Other incidents occur simply because certain dangerous assumptions are made when flying IFR. Take, for example, the case of a pilot who is instructed to "turn right heading 270 degrees and intercept the localizer." After maintaining this heading for a few minutes, the pilot realizes that the aircraft will not intercept the localizer on the assigned heading because of a strong crosswind. Taking matters into his own hands, he turns farther right to make the intercept. This is a no-no because an unannounced turn can foul up in-trail, traffic separation. If a larger intercept angle is required, ask for it.

Another potentially puzzling situation is shown in figure 2. Prior to departure, the pilot was cleared to the Livingston Airport, "via V26, V27, direct." While enroute and shortly after passing the Alpha VORTAC, the pilot is cleared for a VOR approach to the airport. This presents three possible courses of action. The pilot can turn directly toward the Delta VOR, he can continue along V26 until reaching Bravo (an initial approach fix) and then proceed via the published transition, or he can continue via the last assigned routing (V26 and V27). Of these choices, what is the pilot *expected* to do?

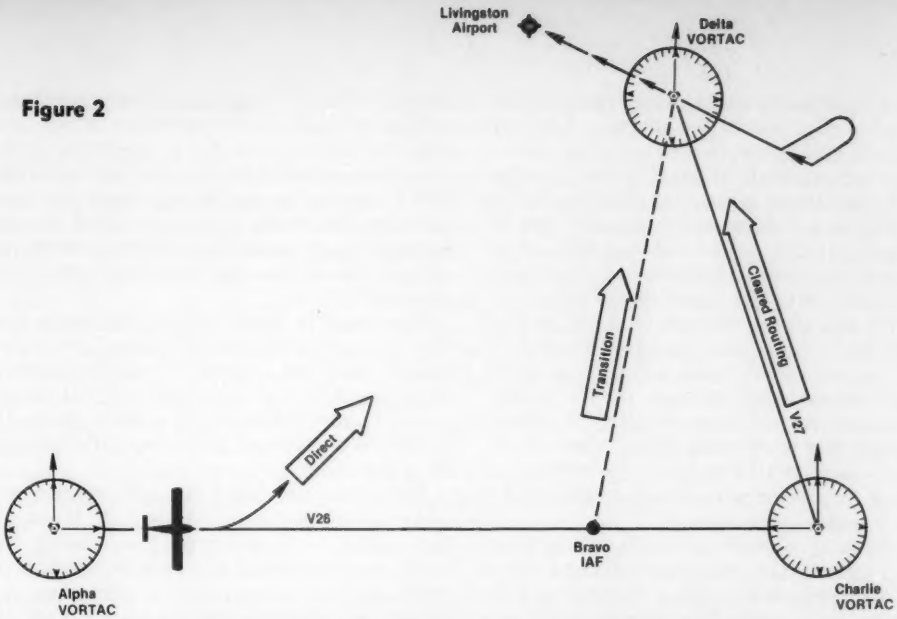
According to a recent survey regarding this problem, 41 percent of the participating pilots indicated that they would proceed directly toward the Delta VOR, 12 percent preferred the transition route and the remaining pilots (47 percent) chose to fly the airways.

As far as ATC is concerned, a pilot is free in this case to fly either of the published routes. The 41 percent who chose to fly the direct route would have collided with a mountain not shown in enroute, IFR charts.

Pilots also get into hot water and jeopardize their certificates by requesting a controller to waive a regulation. Recently, for example, a pilot advised the tower of his intent to perform aerobatics in the control zone. The controller simply acknowledged the pilot who interpreted this as tacit approval for what he was about to do. Chalk up one violation against the pilot. *A controller does not have the authority to waive any published regulation.*

There are numerous traps in the ATC system,

Figure 2



and even the pros get caught making assumptions that can result in accident statistics. As procedures become more complex and communications become a battle of semantics, it behooves a pilot to question anything about which he is in doubt. For many, this is a difficult pill to swallow. It is a form of ignorance they are reluctant to admit. But unless a pilot thoroughly understands what is expected of him at all times, picking up the mike and requesting clarification can be one of the most important survival techniques he'll ever use.

Pilots and controllers both are guilty of adding to confusion by using improper terminology. Air carriers, for example, have been requesting descents at "pilot's discretion." The purpose of this is to remain high as long as is practical in an effort to save fuel.

As a result, you'll often overhear something like this: "Flight 760, descend to six thousand, pilot's discretion."

The pilot gets cute and responds, "Roger, six thou, Papa Delta."

"Papa Delta," of course, has come to unofficially stand for "pilot's discretion." The controller picks up on this jargon and uses it when controlling someone unfamiliar with the phrase. A Comanche, for example, was cleared to "four thousand, Papa Delta."

Before the confused pilot had a chance to respond, another pilot piped up with, "Center, this is November Four Papa Delta, did you call?" Nonstandard terminology is easily misinterpreted and using it is a dangerous habit.

In response to NTSB's recommendations regarding the TWA accident, FAA assigned a task force to develop a "Pilot-Controller Glossary" in an effort to prevent misunderstandings caused by unfamiliar phraseology.

After reviewing a proposed draft of the glossary, I must admit that this is a significant step in the right direction, but am disappointed that the presentation isn't more down-to-earth "legalese" is used profusely....it is published in the AIM, the glossary should be mandatory study for all pilots who use a radio. In addition to clarifying previously undefined terms, some new ones have been added such as "closed traffic" which means "successive takeoffs and landings without leaving the traffic pattern." Pilots will also learn that when flying a direct route (other than an airway) between two fixes, these automatically become compulsory reporting points. We're also told about special IFR, torching, fast filing, MVAs and what is expected of pilots as a result of various requests and clearances. [This publication has been disseminated to the field.]

Pilots, especially the inexperienced, often are in awe of the faceless voice that booms from the speaker. They respond to controllers' instructions as if they were commandments chiseled in stone by lightning from atop Mount Sinai. But controllers, it must be remembered, are mere mortals and, like pilots, are capable of error. When in doubt, don't hesitate to ask for clarification about a confusing clearance or phrase. Question anything illogical.

Sometimes an instruction from ATC must be

placed in proper perspective. Take, for example, the case of a pilot about to execute a VOR approach. He is told by approach control to contact the tower "at the VOR." Passing the final approach fix (the VOR, in this case) is usually the busiest phase of a nonprecision approach, and the least important duty is to contact the tower. Communications should be delayed, therefore, until four of the "five Ts" have been satisfied: (1) time (start stopwatch); (2) turn (toward the final approach course); (3) tuck (begin descent); (4) tune (the proper radial); and, after these duties have been accomplished (5) talk (to the tower). Numerous approaches have resulted in misses (and worse) simply because pilots were so unnecessarily anxious to report to the tower that they failed to properly exercise prudent IFR technique. Fly first; talk later.

Unintentionally and occasionally, controllers make requests or ask questions during critical phases of an approach or landing. If confronted by such a distraction, ignore the controller until you feel it is safe to take the time to respond.

Pilots readily complain about being mishandled by controllers but there are equally valid complaints on the other side of the coin.

Controllers have one particular pet peeve that pilots frequently commit, and it is something that can lead to disaster. The scenario goes like this. The controller issues a clearance to a pilot, but pauses slightly before completing the transmission. Quick to respond, the pilot begins to transmit a reply without realizing that the controller has simultaneously begun to broadcast the remainder of the clearance. The controller releases his mike button in time to hear what he assumes to be an acknowledgement of the entire clearance when, in fact, a key element of the clearance was never received by the pilot.

Other incidents are caused by:

- transmissions containing sound-a-like words and aircraft identifications;
- transposing numbers in transponder codes;
- incorrectly copying a clearance containing a long string of numbers;
- wrong aircraft acknowledging a clearance when this goes undetected by a busy controller;
- a controller who forgets about an aircraft he has told to "standby"; and
- incorrect clearance readbacks not caught by controllers.

FAA is attempting to resolve these and other communications difficulties by improving controller training programs. But the pilot's help is needed. The ATC system cannot work without mutual respect and cooperation. When in doubt about something, ask for a repeat or a clarification. Be alert for partially blocked transmissions. Don't hesitate to speak up when you overhear someone else make a mistake (such as when the wrong aircraft responds or when a controller fails to recognize that a clearance has been read back incorrectly).

Among other items, do not be overly cooperative by accepting dangerously fast approach speeds. Alert the controller when it appears that a radar vector for an ILS approach will not provide a satisfactory intercept or when a lower altitude is needed to establish glide slope intercept prior to the outer marker.

Pilots can also assist the ATC system by exercising tolerance and constraint. It is not unusual for a pilot to misinterpret the harried, frenetic voice of a controller and take personal affront to what appears to be a curt, overbearing attitude. Generally, when a controller sounds rude it is because he is temporarily overloaded with traffic. Pilots can help by being more considerate of a controller's problems.

Unfortunately, a few controllers do overstep their authority and are unnecessarily demanding and dictatorial. Although it is human nature to use the VHF frequencies as the medium for a rebuttal, this can only lead to distractions, misdirected traffic and a generally hazardous environment. Pilots have a far more powerful weapon to use against errant controllers – the pen. Simply state your complaint and submit it along with the time of occurrence to the branch chief of either ATC Evaluations or Operations at the respective FAA regional headquarters. When your letter (or phone call) is received, the tape of the conversation (which is kept for only 15 days) will be consulted and the misbehaving controller will be put on the carpet.

Should a controller, however, require something that a pilot considers unsafe and more immediate action is required, he can respond simply with "negative" or "unable." *A pilot is not obligated to abide by a clearance until it has been accepted.*

The purpose of this critique is not to induce confrontations between pilots and controllers. Enough of such misguided thinking has been published elsewhere. Our purpose here is to simply point out some major problem areas and emphasize that the ATC system consists fundamentally of human beings, all of whom are fallible. The common goal of safety requires alertness, honesty and a clear, understandable channel of communications between everyone involved.

The School Solution

Continued from page 2

qualified aviators and upgraded its fleet from AH-1Qs to AH-1Ss (mods). Plans call for converting to AH-1Ss (new) by the end of the year.

This article covers three general areas: training currently being conducted at the Center; lessons learned in a year of operating the TOW; and target acquisition.

The last area deals with using the TOW system for target acquisition and has applicability to nearly all active Army and Reserve component aviation units that may be involved in searching for targets on the mid-intensity (high threat) battlefield.

Center Training: The course of instruction for the Cobra TOW Course includes 27 hours of academic instruction (figure 1). This instruction covers airframe differences between the AH-1G and the AH-1S; detailed instruction on the TOW Missile System (XM-65); Helmet Sight Subsystem (HSS) (XM-128); and the turret subsystems (M28A1E1).

Each student receives 6 hours of dual flight instruction; 4 hours of practice tracking; 1½ hours of range firing and ½ hour of the use of the pilot steering indicator (PSI). Each student fires 3,000 rounds of 7.62 mm, and 250 rounds of 40 mm using the M28A1E1 turret. This firing gives the student the opportunity to fire live ammunition using both the telescopic sight unit (TSU) and the HSS. One student per class also has the opportunity to fire a TOW missile with a high explosive warhead.

The major goals of the course are:

- to provide the students with detailed knowledge of system operation and integration;
- sufficient opportunity to apply their knowledge and gain confidence in their ability to effectively use the system;
- the importance of crew coordination and cockpit teamwork; and
- to develop the students' ability in using the TSU to smoothly track a moving target.

The detailed instruction on system operation begins in academics, which at the Aviation Center is completed prior to the student reporting to the flight line. Here students are taught airframe differences on the "S" model to include instruction on the hydraulic, electrical, transmission, directional control and engine systems. Also covered are cockpit modifications required for the TOW system, operational limits and performance characteristics. Instruction on the weapons systems includes unit description, location and function of the major components, principles of operation and operator troubleshooting of system malfunctions. Academic instruction also is used as the foundation for some additional flight line briefings on how the missile is guided to the target and the time sequence involved in missile launching.

On the flight line orientation covers effective use of the system. One of the prime vehicles for accomplishing this is the AH-1S checklist. The checklist outlines the armament check to be performed after engine runup. In following these checks, the crew puts the systems into operation and also manipulates the major switches and controls, checking for proper operation. A crew that understands and follows the checks will be able to effectively employ the system. The length of time required to complete these checks also may serve as a measure of crew confidence and cooperation. A well trained crew should complete the checks in 5 to 8 minutes, roughly the same length of time required for the engine start and runup checks.

Crew coordination and cockpit teamwork always have been important in the Cobra. But they will be even more important in the Cobra TOW. In the AH-1G the pilot fires the primary weapons system while doing the majority of the flying. The gunner performs the crucial tasks of NOE navigation and can provide covering fire with the turret.

In the Cobra TOW (AH-1Q and AH-1S), the pilot still does the flying but also provides covering fire with the turret using the

Figure 1 COBRA TOW COI

Academic Subjects	Hours	
AH-1S differences	5	
Cockpit familiarization	2	
Operating limitations/characteristics	1	
Introduction to TOW	1	
TOW Missile System (TMS) unit description	3	
TMS operations, malfunctions and trouble shooting	3	
TMS safety precautions	1	
Introduction to the helmet sight subsystem	1	
Cockpit procedures	2	(PE*)
TMS tracking and firing practice	6	(PE)
Exam and critique	2	
	27	
Flight Subjects		
TMS tracking	4	(Dual)
M28A1E 1 firing	1.5	(Dual)
Use of pilot steering indicator	.5	(Dual)
	6.0	

* Practical exercise

Figure 2 TARGET HANDOFF — PILOT TO GUNNER

Pilot	Gunner	Item Description
Gunner		Alert
Tank		Target Description
On Ridgeline		Visual cue to assist gunner in target location
	Acquisition	Gunner states when PHS button is released. Indicates TSU has target and that pilot can move his head
	Tank — T-62	Gunner identifies as either friend or foe
	Moving Left to Right	Gunner specifies movement so pilot can plan for prelaunch constraints
	2 Mils	Gunner states width, in mils, of target
	3,400 meters	Gunner uses WORM formula to estimate range

HSS, while the gunner fires the primary weapons system, the TOW.

Crew training is enhanced by maintaining crew integrity to the greatest extent possible. Repeated battle drills with the same crewmembers greatly reduces required engagement time and enhances crew survivability. Crew coordination is addressed in the TOW course by involving both members in the armament checks, various discussions on target acquisitions, engagement and disengagement techniques (as outlined in TC 1-4, "Helicopter Gunnery") and a target handoff procedure to be used when the pilot acquires a target of opportunity and wants the gunner to engage it using the telescopic sight unit (figure 2).

A part of the flight training involves the gunner tracking a moving target and receiving feedback from the instructor pilot (IP) in the form of a numerical score produced by the gunners accuracy control panel (GACP, but also commonly referred to as a GAZAP). The GACP measures how consistently the gunner tracks a moving infrared target (M-89 target source).

The scores displayed by the GACP indicate the relative consistency with which students tracked the target in both the horizontal and vertical axes. This device, while extremely valuable in initial qualification, has little application in tactical training and may not be widely available in the field units. (See page 3 for more information on Cobra TOW training devices.) A crucial lesson students encounter while learning to track smoothly is that they can be their own worst enemies. The reason is that the track stick, unlike a helicopter cyclic, does not move in response to pressures applied

Figure 3 Pilot should maintain 125 feet AGL when gunner uses TSU sight device. In case of electrical power failure the turret automatically reverts to gunner's helmet sight for positioning commands. If gunner is looking down into TSU rounds will impact just below the aircraft

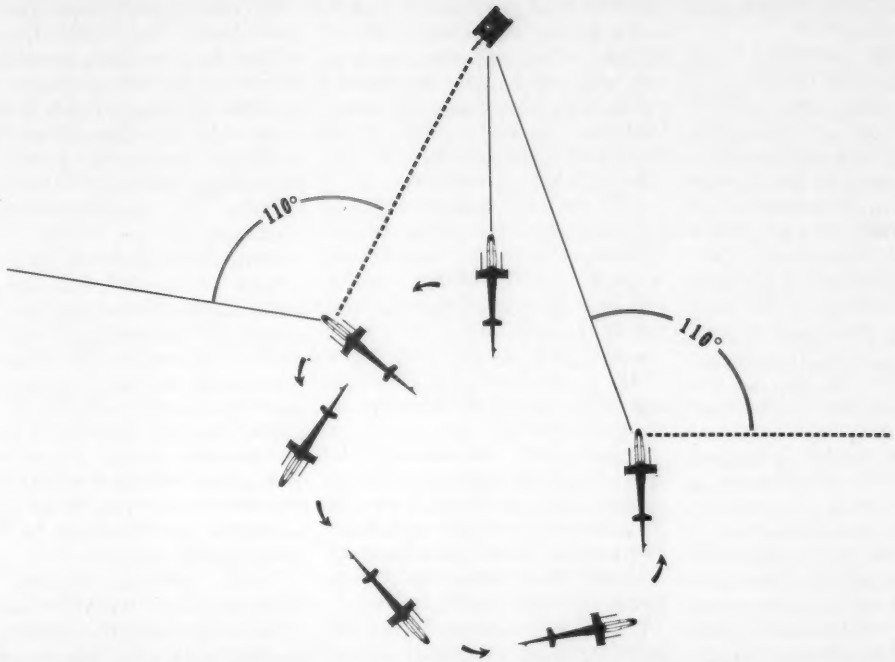


Figure 4 Position of the Stow/Track/Acquisition switch must be checked carefully when firing turret. When in track the turret follows the TSU. Above a Cobra fires at extreme angle due to drift of TSU

to it. It merely measures the pressures applied and moves the TSU accordingly. Errors are increased if a great amount of pressure is applied to the track stick. A very light touch is sufficient to produce the desired results. The course also includes a basic introduction to vehicle identification, range estimation using the 13X optics, and boresighting of the TOW Missile System.

Lessons Learned: Below are some characteristics of the system learned in the school of hard knocks.

• Heed the warnings on page 4-1 of the "S" model -10 (Change 3). When the gunner is firing the turret using the TSU as the sighting device, maintain 125 feet altitude. Should electrical power to the TSU fail (and it has) the turret will automatically revert to the gunner's helmet sight for its positioning commands. Since the gunner is looking down into the TSU, the rounds will impact just below the aircraft (figure 3). (Does not apply to new (production) "S.")

• Remember to physically check the position of the Stow/Track/Acquisition (S/T/A) switch when firing the turret. When selecting the TSU/Guns mode for turret firing, the only switch that determines whether the turret takes its positioning commands from the TSU or the HSS is the S/T/A switch. When in the stow position, the turret responds to the HSS. When in track, the turret follows the TSU. See figure 4 for an idea of what can go wrong. [Gunnery IP's note: When the gunner selects TSU/Guns, and depresses the left hand grip action bar, the PSI indications are no longer valid.]

• Exercise extreme caution when using the HSS to fire the turret. It's human nature to turn the head and look at anything that catches the eye. Should an aircraft suddenly unmask to your side while you're firing, you'll want to turn and look at it. Don't do it while you are firing or you'll shoot your wingship down. Many other flying duties require us to have our "heads on a swivel," but remember to concentrate on your target during firing. Let the non-firing crewmember's head "be on a swivel."

• When firing missiles with more than one TOW aboard use either the Manual Armed Mode or release the action bar and trigger after missile launch. If the action bar and trigger are held depressed, and the Mode Select is in Auto Armed – and if the pilot still has the aircraft in prelaunch constraints when the first missile hits the target – a second missile will initiate its

firing sequence after the first missile hit the target.

• Check your Left Hand Grips (LHG) to see that they have a modification work order (MWO) number stamped on them. The unmodified LHGs have a problem when switching from *low* to *high* magnification. The optics will switch from low to high, but a sticking relay sometimes prevents the remainder of the system from switching to the high power setting. The result is that the gunner is viewing through the 13X retricle, but still has the fast slue rate, and will not be able to fire a missile.

• When the gunner is looking through the TSU, particularly in high magnification, the concentration area is on a given point – the target. The effect is tunnel vision. The gunner may not realize the aircraft is moving and may not notice that something is about to interrupt the direct line of sight. The result can be that the gunner does not compensate for a changing range to the target or fails to give the pilot ample warning that something is about to break direct visual contact with the target (figure 5).

• For unit training without a gunner accuracy control panel, you will need to save and rewire some expended missile tubes. Without a rewired tube, the system will not display the *attack*, *ready*, or *fire* flags for crew training. Contact your local technical representative for details on rewiring the tubes.

• To optimize gunner orientation and minimize wear on the system, the gunner should always go to Low Magnification and Stow position when not viewing through the TSU.

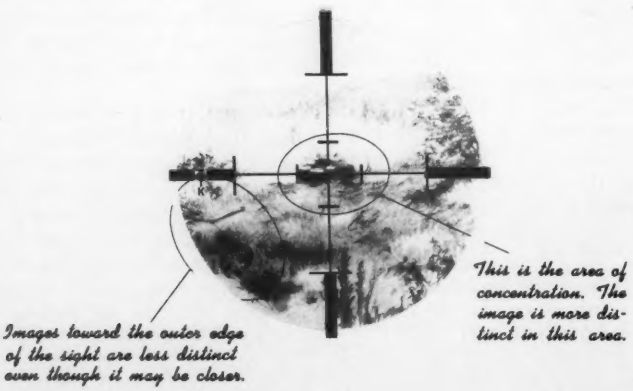
• A missile with a 3,000 meter range is designated BGM71-A, one with a 3,750 meter range is designated BGM71-A-1.

• Have the gunner double check the estimated range to the target using the WORM (width in meters over mils) formula. The gunner can most accurately estimate range using the 13X optics in the TSU (figure 6).

• The references found in figure 7 should be helpful.

Target Acquisition: Army doctrine calls for the initial search for and acquisition of targets to be accomplished by elements other than the attack helicopter. But the fact remains that once the attack helicopter unmasks in the firing position, it still has to make visual contact with the target before it can fire on it.

Figure 5 Tunnel vision effect


This is the area of concentration. The image is more distinct in this area.
Images toward the outer edge of the sight are less distinct even though it may be closer.

We can expect that on the mid-intensity battlefield, targets will not be as obliging as those to which we are accustomed. Our gunnery training often has been conducted on cleared ranges with no attempts made to camouflage the targets. And, the targets have most often been stationary.

Compare this to what we could expect in combat. The targets when stationary would be concealed and camouflaged. On the move, they will be making maximum use of camouflage and concealed avenues of approach. Attack helicopter pilots still have to conduct a search to find targets. Cross training with our scout crews can be of great value to us training to accomplish this job.

Three general means of searching have been developed while using the TOW systems to search for targets. Before going into these it is helpful to discuss factors governing the type of search technique to be used.

Two basic factors govern the type technique to use. The *first* is the nature of the terrain. Evaluation of probable avenues of approach, landforms restricting maneuver, and maximum observable range obviously are going to be evaluated. The *second* factor is the type of target information received.

A "worse case basis" might be that we only know that the targets are in front of preplanned attack position "A." This requires a search of a much larger area then if we knew that there were three tanks on a heading of 150 degrees, at a range of 2,500 meters, from attack position "A."

The three means of searching are:

• Both the pilot and gunner use their helmet sights. This would be required when the situation dictates search of a large area,

such as that given in the "worse case" situation above. The pilot and gunner both search with their helmet sights. When locating a target or suspected target, the gunner manipulates the appropriate switches and takes a closer look using the magnified optics in the TSU.

• The gunner searches with 2X optics while the pilot searches with the HSS. This is used when information available falls somewhere in between the situations mentioned above. Using the 2X optics the gunner has a 28-degree field of view and about a 70 feet-per-second slue rate with the TSU. This allows coverage of a relatively restricted area (30 degrees to 60 degrees depending on terrain) in detail in a relatively short period of time. Remember exposure time will be a critical factor in crew survivability on the mid-intensity battlefield.

• The gunner searches with 13X optics while the pilot searches with the HSS. When the target is known to be in a relatively small area, the pilot can unmask the aircraft on the known heading to the target and the gunner can search with the 13X optics. Here the gunner has 13 power magnification of the target area. This allows picking out greater detail but imposes a 4.6-degree field of view restriction and a slue rate of only about 4 degrees per second. Obviously a large target area would be difficult to cover in a reasonable amount of time.

The three means of searching listed above are tied to the TOW system. But the concept behind them applies as well in deciding whether or not binoculars would be used by a scout when searching a given target area.

Some general thoughts on searching:

• Reflection : Very few things in nature reflect the Sun. If you see Sun shining off an object it's more than likely man-made. If it's man-made and in your target area, it may well be your target.

• Smoke: Nearly every tank in the world emits a plume of exhaust smoke. In a conflict situation, where vehicle maintenance hasn't been performed quite as often as it should, this exhaust smoke is likely to be very pronounced.

• Dying camouflage: If a unit remains in a defensive posture and doesn't regularly replace its camouflage, this gives away its position.

• Outline: Few things in nature have square corners and straight edges. Even if a vehicle is partially camouflaged, these may be detected and should cue us to take a closer look.

• Sun: Whenever possible try to have the Sun at your back or side. It's much harder to find a target when looking into the Sun, so make the enemy's job more difficult – not yours. Having the Sun at your back also enhances the possibility of catching the Sun reflecting off the target.

Figure 7

References

a) TC 1-4 Helicopter Gunnery — Particularly Chapter 1, and the formula for range estimation on page 43.

b) TC 17-17 Gunnery Training for Attack Helicopters.

c) FM 90-1 Employment of Army Aviation Units in a High Threat Environment.

d) TM-55-1520-234-10, -CL, and -23, AH-1S (Mod) Operators and Maintenance Manuals and checklist.

e) TM 9-1090-203-12 Operator and Organizational Maintenance Manuals on the M28A1Ea turret.

f) TM 9-1270-212-14 Operator, Organizational and Direct Support Manual on the XM128 Helmet Sight Subsystem.

g) TM 9-1425-473-20 and -34 Maintenance Manuals on the XM-65 TOW system.

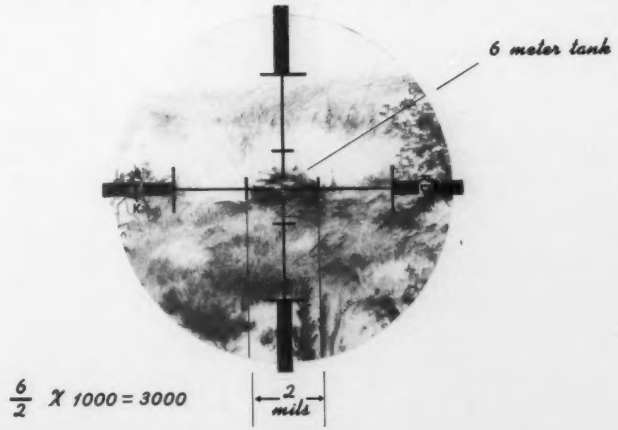
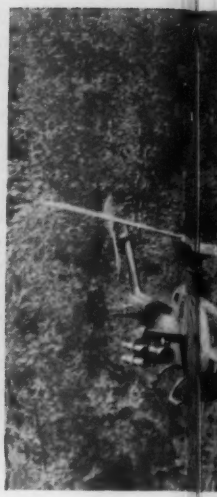


Figure 6 Site image and WORM formula

$$\frac{\text{width of target in meters}}{\text{mil value}} \times 1000 = \text{Range}$$



Army Aviation Center

Located on the western boundary of Fort Rucker, Lowe Army Heliport (1) serves as the base field for UH-1, OH-58 and AH-1G/S aircraft. In all, 117 aircraft are maintained at Lowe. These aircraft support the undergraduate transition and tactics training, AH-1G qualification and instructor pilot (IP) training, and several UH-1 IP courses. With the introduction of the night qualification portion of the undergraduate flight program, Lowe Army Heliport will operate 24 hours a day.

Matteson Range (2) is the principal aerial gunnery range. This facility can support all the weapons systems in the active inventory. By using the surrounding terrain (see AH-1 HueyCobra above) gunnery runs are made using nap-of-the-

earth (NOE) doctrine.

Tac Runkle (3) is a multiuse facility which supports tactics training and is located in the middle of the tactics training area. Aviators are exposed to rapid refuel, tactical GCA and under the wire flight techniques. In addition, students have an opportunity to maintain proficiency on the various nonstandard maneuvers.

Skelly Stagefield (4) is a converted fixed wing training facility that now is used for the UH-1 transition phase of the undergraduate flight program.

Below, a TH-55 Osage performs NOE flight in the vicinity of a stagefield used by the Department of Undergraduate Flight Training.

At A Glance, IV

EPMS CORNER

Promotions

SFC W. E. Trotman
U.S. Army Military Personnel Center
Alexandria, VA

WHEN SOMETHING IS not understood, it can be a frustrating thing to make sense of it. *Where do I look; who do I ask?* When it comes to Army policy, knowing who to ask or where to look can clear problems up and make things easier to understand.

Let's take promotions – an area of major concern to Soldiers at all grades. Every Soldier should understand the Army's enlisted promotion policy, not only for his or her sake, but also for that of subordinates and coworkers.

The enlisted promotion "bible" is Chapter 7, AR 600-200. Chapter 7 contains an Armywide promotion policy which sets Armywide opportunities for advancement.

The objectives of the Army promotion system are to fill authorized enlisted spaces with qualified men and women who have demonstrated potential for increased responsibility; provide for career progression and rank which is commensurate with ability and potential; attract and retain high caliber individuals for a career in the Army; provide an equitable system for all Soldiers; and, preclude from promotion the individual who is nonproductive/nonprogressive. Attainment of these objectives would present a challenging goal for the Soldier seeking advancement.

Subject to Department of Defense (DOD) constraints and the necessary exercise of authority and responsibility of higher commanders, the authority to promote is delegated to the commanders indicated for the following grades:

- For promotion to pay grades E4 and below – company, troop, battery and separate detachment commanders.
- Field grade commanders, of any organization which is authorized a commander in the grade of lieutenant colonel or higher, may promote assigned personnel to pay grades E5 and E6.
- Department of the Army (DA) retains the promotion authority to pay grades E7, E8 and E9.

A higher commander within the chain of command may restrict the exercise of promotion authority by a subordinate commander.

The eligibility criteria for promotion to grades E2 through E6 is listed in Sections II and III, Chapter 7, AR 600-200. Your first sergeant and personnel staff noncommissioned officer (NCO) are highly qualified to assist you with questions you may have.

By using the standardized promotion scoring forms with predetermined promotion point factors, Soldiers can generally measure how well they qualify for promotion. Precise goals can be set within a self-improvement training program to increase potential for promotion. Soldiers will be recommended for promotion only after they develop the skills and abilities to perform the duties and assume the responsibilities of the next higher grade. Promotions will not be made to recognize a job well done, but rather to recognize the individual with potential for leadership or increased technical skill in his or her chosen field of specialization. It also follows that, if Soldiers do an outstanding job in their present grades, they probably have the competence to perform well in the next higher grades.

A centralized promotion system has been in effect for the promotion of enlisted personnel to pay grades E9 since 1 January 1969, E8 since 1 March 1969 and to grade E7 since 1 June 1970. Basic eligibility for consideration for promotion to grades E7, E8 and E9 is based on date of rank, high school education and cumulative enlisted service creditable in the computation of basic pay. Headquarters, DA will announce the primary and secondary zones of consideration for each grade. No provisions exist whereby an individual may decline promotional consideration.

Under the centralized system, individuals may not appear before a selection board on their behalf or in the interest of another person who is in a zone of consideration. Soldiers within an announced zone of consideration may write a letter to the President, DA Selection Board, inviting attention to any matter of record on file at HQDA which they feel important in the consideration of their records. Such letters may not contain reflection upon the character, conduct or motive of any individual. Letters of this nature will not be acknowledged and will not be used as a basis for promotion reconsideration. Letters of commendation, appreciation, recommendation for promotion may be forwarded directly to the selection board when such a board is in session.

Selections by DA selection board are based on impartial consideration of all personnel eligible

for promotion in the zone. Selection boards use the "best qualified" method of selection for promotion to these grades. Under this method selection boards recommend a specified number of individuals from the zone of consideration who are considered to be the best qualified to meet the needs of the Army. The number of selections which may be made is that number which is projected by the Army to be required to maintain its authorized-by-grade strength at any given time.

The analysis of the individual's background will include, but not be limited to, a careful evaluation of the following factors:

- Scope and variety of assignments and how well performed
- Degree or level of responsibilities
- Trends in efficiency
- Length of service and maturity
- Moral standards
- Integrity and character
- Awards, decorations, commendations and recommendations
- Education – civilian and military
- General physical condition

Selection board action is administratively final. Reconsideration for promotion will be afforded only when substantial material error is determined to have existed in the records considered by the regular constituted board or when adverse suitability information concerning an individual already recommended but not yet promoted is revealed and the information would appear to warrant removal from the recommended list. A removal determination will be based on the recommendation of the standby enlisted advisory board convened at Headquarters, DA. Promotion reconsideration does not apply to personnel in a secondary zone whose records were available to the board. For those in the secondary zone, the Standby Enlisted Advisory Board will consider only those Soldiers whose records were not available to the regular board.

Soldiers not selected for promotion by DA centralized enlisted selection boards will not be provided specific reasons for nonselection, as board members are not required to record or divulge any reasons for selection or nonselection.

Summary: Promotion in the Army is based on demonstrated and potential ability and is not intended as a reward for performance in the present grade and duty. Therefore, no single factor is allowed to become overriding in determining whether the individual can perform the duties and exercise the responsibility of the next higher grade.

The Army wants to promote qualified Soldiers. But those selected should be willing to return the promotion investment to the Army by making themselves available for Armywide assignments when called upon. The point needs reemphasis. If Soldiers accept promotions, they should be willing to accept the accompanying responsibilities and make themselves available for Armywide assignment.

Officer Personnel Management System

OPMD CORNER

Personnel — ACIA — Astronauts

Major Thomas M. Walker
Aviation management Branch
Officer Personnel Management Directorate

Aviation Management Branch, OPMD: Two positions in the Aviation Management Branch, Officer Personnel Management Directorate (OPMD), have new faces. They are: branch chief, LTC George A. Morgan; and specialty 15 monitor, MAJ Ben Couch. LTC Morgan's previous assignment was as commander, 24th Aviation Battalion, while MAJ Couch served as executive officer of the 25th Aviation Battalion. Both officers bring with them to these important positions a combined total of more than 30 years of aviation experience.

Senior and Master Aviator Badges: Army units requiring Senior or Master Aviator Badges for presentation at award ceremonies may obtain them at Government expense through the U.S. Army Support Center, 2800 South 20th Street, ATTN: STSAP-AS, Philadelphia, PA 13101. Request for badges should be in a military letter format, signed by unit commander or adjutant, and include a justification statement. Normal order-to-ship time is about 3 weeks.

Aviation Career Incentive Act (ACIA) Data Corrections: DA Circular 600-11, "Aviation Career Incentive Act Flying Data," announces the fiscal year 1976 aviation data as required by the ACIA of 1974. The aviation data recorded in the circular includes: aviation service entry date (ASED); cumulative months of total federal officer service (TFOS); and months of

total operational flying duty credit (TOFDC). Aviators are encouraged to review current data for accuracy and direct questions to their servicing military personnel office (MILPO). Questions which cannot be resolved at the local level may be directed to the CDR, MILPERCEN, ATTN: DAPC-OPP-V, 200 Stovall Street, Alexandria, VA 22332 or telephonically: AUTOVON 221-0727/0794; commercial (202) 325-0727/0794. Requests for changes in aviation data (ASED, TFOS, TOFDC) must be accompanied by appropriate documentation to justify the change (e.g., Officer Efficiency Report, DA Form 2-1, orders, or DA Form 759).

Army Astronaut Program: Thirteen Army aviators were among 33 Army officers nominated to the National Aeronautics and Space Administration (NASA) for service as either astronaut pilots or mission specialists in the Space Shuttle Program. The Army nominees, along with nominees from the civilian community and other Department of Defense services, will be competing for 40 space shuttle crewmember positions – 20 pilot and 20 mission specialists. The NASA Selection Board convened on 1 July 1977 and will remain in session until 31 December 1977, at which time the board results are expected to be announced.

Figure 1

PROJECT MANAGER

Technical Feasibility
- Alternatives
- Cost & Risk Assessment
- Design Characterististics
- Scheduling

Field System
- Post Deployment Support

Development Testing
- Correct Deficiencies

Development Plan
- Determine Tradeoffs
- Technical Characteristics
- Logistic Support Package
- Training Support Package
- Personnel Support Package

***COEA/CTEA Input**
- Technical Alternatives
- Costs

TRADOC SYSTEM MANAGER

Input To Development Plan
- *COEA/CTEA
- Logistic Support Plan
- Training Support Plan
- Personnel Support Plan
- Tradeoff Analysis

Force Integration
- Product Improvements

Requirement
- Operational Deficiency
- Operational Concept
- Military Characteristics

User Testing
- Validate Performance
- Validate Tradeoffs

*COEA/CTEA= Cost & Operational Effectiveness Analysis/Cost & Training Effectiveness Analysis

TRADOC System Manager

Continued from page 1

cycle and that plans and requirements in all areas (personnel, training, logistical, operational, organizational, test and doctrinal) are developed and fully integrated early. The total system approach continues throughout the life cycle of the weapons system.

The TSM does not replace nor duplicate the Army Materiel Development and Readiness Command (DARCOM) project manager. The TSM represents the user first and foremost and interacts with and complements the project manager as shown by figure 2.

Each TSM has a small staff of three that integrates, energizes and ensures that the TRADOC system as it exists today, and in the future, works. The TSM is the focal point for all user interests. He will actually pull together the TRADOC effort and coordinate the work with the DARCOM community. More importantly, he will work for and with the Army Staff representing the user. The TSM responsibilities and authority are shown in figure 3.

Figure 2

TSM - AUTHORITY

- Chartered
- Derivative From Avn Cen Commander
- Coordinate TRADOC Tasking
- Coordination - All Levels

TSM - RESPONSIBILITIES

- Coordinate With MACOMS
- Review Contractual Actions
- User Input To Life Cycle System Management Model
- Ensure Force Integration
- Participate In Decision Reviews
- Interface With DARCOM
- Special Study Group/Task Force Member
- Defend System Requirement
- COEA (*figure 2) Preparation
- Participate In Testing (Planning & Test Design)
- Interface With PM
- Review PM Tradeoffs
- Represent Avn Cen Commander Or Commanding General TRADOC
- Prepare TRADOC Position
- Schedule & Integrate User Activities

Gunner Training Devices

Continued from page 3

The XM-65 TOW missile system is employed by highly skilled pilot/gunner teams, trained to track and destroy enemy armor targets at ranges out to 3,750 meters.

Due to increased emphasis in the antiarmor roll of the Cobra TOW on the battlefield, much interest has been directed toward the training that gunners receive both during initial system qualification (see "TOW Cobra – The School Solution," page 2), and later at the unit level. Interestingly enough, many TOW qualified gunners have never fired a missile.

Of the nine gunners being graduated by the U.S. Army Aviation Center, Ft. Rucker, AL every 2 weeks, eight never have had the rewarding sensation of killing a tank. Trained gunners subsequently are assigned to tactical units where, as at Ft. Rucker, the high cost of ordnance allows very little if any live missile firings.

The low, livefire experience level of Cobra gunners raises concern for their proficiency and ability to destroy armored targets if and when they are called upon to do so. But this problem could be offset by training devices, should they prove effective and feasible to procure. One such device is the gunner accuracy control panel (GACP).

The GACP (figures 1 and 2) is a device initially designed to demonstrate that gunners could track targets smoothly with the XM-65 airborne sighting system. It was adopted as a "training device" by the Army Aviation Center where TOW instructor pilots (IPs) receive feedback about the student's tracking progress. Feedback consists of numbers representing the tracking error made as a gunner aims and maintains the sight on target for 12 seconds – a typical scoring interval.

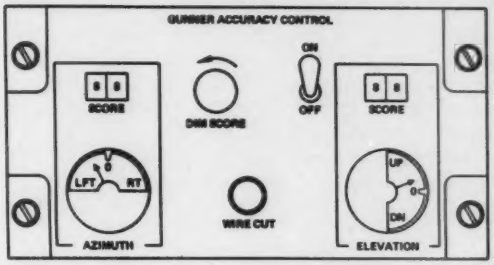
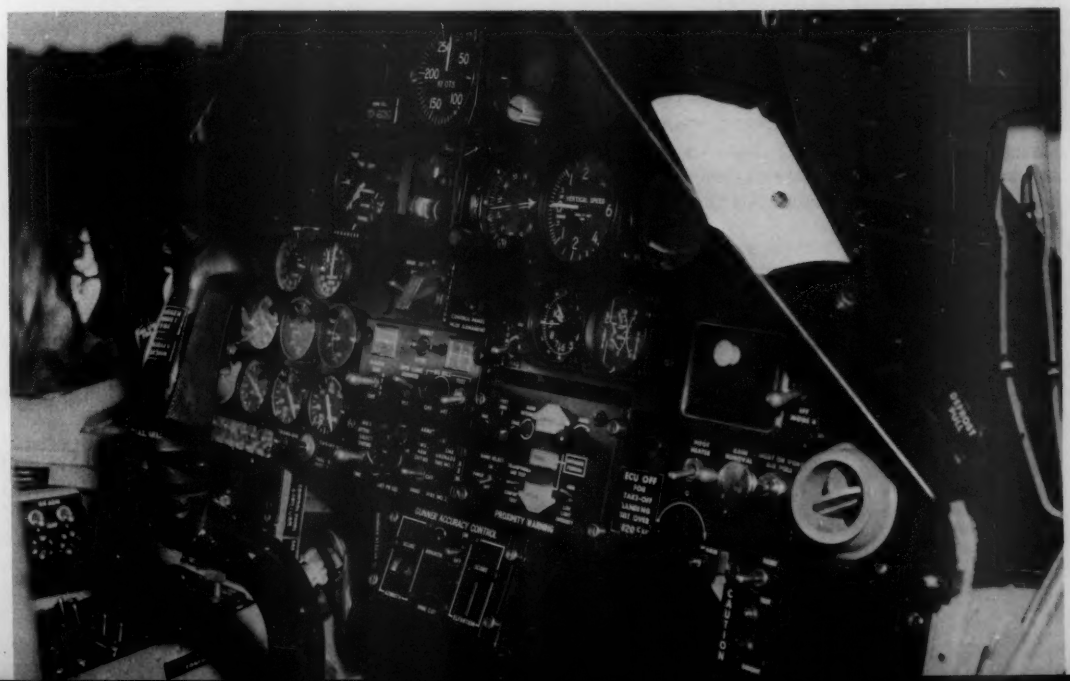


Figure 1 Schematic drawing of GACP control panel

During the 12-second scoring sequence, the sight must track a conditioned target. The M-70 target source, powered by the electrical system of a tactical vehicle, provides the infrared (IR) energy necessary for detection by the telescopic sight unit (TSU).

The TSU contains IR detectors which discern emitted energy and its location (IR line of sight (LOS)). This can be compared to the gunner's aiming point (optical LOS). When these two lines

Figure 2 Gunner Accuracy Control Panel (GACP)



are not aligned, the GACP deducts points from a maximum total of 99, proportionate to the percentage of time and displacement of the aiming error. As tracking error decreases, the GACP scores increase, indicating the gunner's tracking improvement to the instructor.

GACP scores for each student gunner were averaged with scores of all other gunners for 1 year. This provided a mean score for comparison purposes. Student GACP scores became the grading system for determining the below average, average and better than average gunner graduates. This process did not provide a means to determine what a graduating gunner's hit probability (PH) [in formula the "H" would be lowered half a letter] would be against enemy armor.

The mean GACP score of all previous graduates of the AH-1 Cobra/TOW Gunner Qualification Course is 73. The lowest average score for any one gunner was in the low 60s and the highest in the mid- to top 80s, yielding an average deviation of plus or minus 15 points.

Can gunners' average GACP scores be converted somehow to indicate hit probability? If so, how significant is the 15-point GACP score deviation when represented by PH? To answer these questions formulas and charts were derived from extensive computer simulated missile firings by the system's manufacturer. They were prepared to allow a gross estimation to be made of hit probability for GACP scores. The equation is found in figure 3.

The results of the equation are plotted on a PH chart. There are five charts developed from computer simulated launches at 2.5; 2.75; 3.0; 3.5; and 3.75 kilometers (km). The scores are inserted in the chart corresponding to the launch range. Graduate gunners' scores at the Aviation Center course were obtained while tracking at 1,700 meters, a range for which a chart is not available. Hopefully, future classes will be scored at ranges comparable to available charts and/or the device manufacturer will develop graphs for more variable ranges.

Figure 3

$$\theta el = \frac{113.5 - \text{GACP Score (elevation)}}{532} = \Sigma \text{ elevation}$$

$$\theta az = \frac{113.5 - \text{GACP Score (azimuth)}}{532} = \Sigma \text{ azimuth}$$

$$\theta az + \theta el = \Sigma_t$$

Σ (sum)	θ (theta)	Σ_t (sum total)

For demonstration purposes, when applied to the 2.5 km chart, the graduating student scores result in a PH approaching 1.0 (PH→1.0) for the mean GACP score of about 73. The PH for the lowest score of about 60 is PH→98, assuming the gunner received a 60 in azimuth and a 60 in elevation. Therefore, graduate gunners of the Cobra/TOW Gunner Qualification Course, though deviating 15 GACP points around a mean score of 73, deviate only one point around a mean PH of about .99.

For an azimuth score of 93 and an elevation score of 13 the PH at 2,500 meters would be about 85. The same GACP scores attained at 3,750 meters would result in a PH of only .40. Note that the ability of the gunner to maintain the sight on target at long ranges and close ranges equally well results in a higher PH at the short ranges. Theoretically, the reverse should hold true. However, PH decreases at longer ranges due to IR tracker noise and system imbalances, in addition to gunner tracking error.

Thus, when GACP scores are converted to milliradian tracking error, they can generate PH estimates for gunners when simulating missile launch and target tracking. GACP operating limitations include but are not limited to the following requirements:

- An unobstructed LOS between the gunner and target.
- A conditioned M-70 IR target source.
- A rigid standardization of variables such as target range, speed, direction of movement, and aircraft altitude and speed.
- There currently is no source of information in the form of training guides or manuals to describe typical, standardized GACP scoring criteria, or conversion tables to indicate PH.

Why procure GACP, a scoring device, to evaluate gunners when their hit probability of .99 at graduation rarely varies more than 1 point? Have not PH charts left the impression that the TOW system, designed for simplicity of operation, meets that specification and in so doing eliminates further skepticism over the proficiency of TOW gunners? Possibly, however, the PH averages of gunners are representative of institutional, basic tracking skill. They do not reflect tracking under combat conditions.

Testing has shown that PH decreases during tactical tracking and engagement scenarios. Recent testing indicates that GACP can reduce training time and now, with PH conversion formulas available, it eliminates the requirement to fire a missile to verify tracking performance.

Preliminary tracking tests taken by student gunners during a recent Aviation Center study resulted in a .92 PH mean score before *any* training took

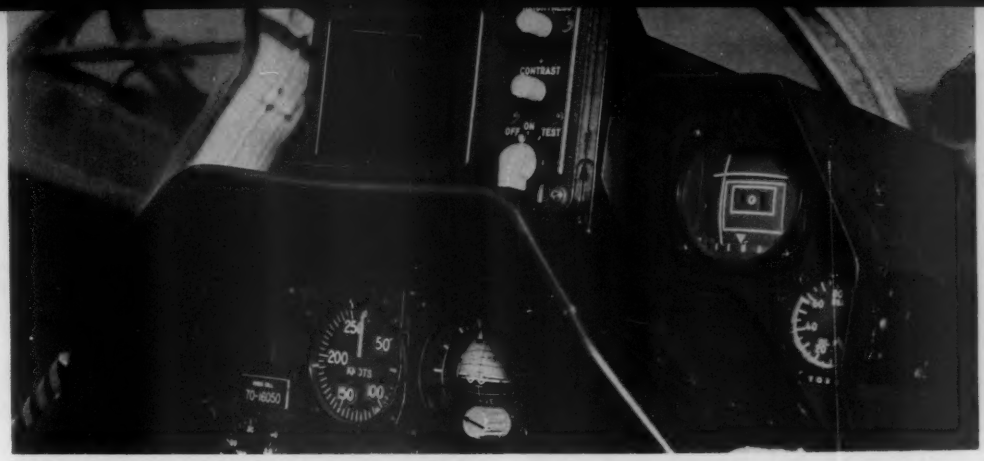


Figure 4 TOW Missile Sight Video Camera System (TMSVCS)

place. Only academic training and a 2 to 3 minute introduction to tracking was performed before this test. Students all progressed to a PH that approached 1.0 in less than 2.5 hours. The XM-65 is a highly accurate weapons system, and when fired in an institutional training environment, hit performance results are excellent.

Because of the reduction of time required to reach peak tracking performance levels with a training device, it may be practical to revise the 4 hours of institutional tracking time to include some combat tracking training in which GACP scores could then be based on combat tracking skill. These scores would indicate a realistic assessment of battlefield PH and training time could be used to improve *this* performance. Thus, student graduates would be better prepared to combat the real armor threat.

A newer training device than GACP is in the prototype stage of development. It is the TOW Missile Sight Video Camera System (TMSVCS) (figure 4). Unlike GACP which was designed to demonstrate a contract specification, the TMSVCS was built primarily as an airborne TOW training device. The system consists of three major components:

- A video camera installed in the TSU gun camera mount.
- A video recorder mounted behind the pilot's seat to record what the camera sees (recorded information later is played back in the debriefing room on a TV screen with a cassette type video tape attachment).
- A cathode ray tube (CRT) mounted atop the pilot's instrument panel in place of the M-73 sight.

The monitor allows the IP to view what the gunner is viewing in the TSU anytime the system is being powered. Gunner tracking ability is observed in the CRT by monitoring movements of the TSU crosshairs offtarget caused by gunner tracking error. Primarily, the TMSVCS provides the IP an indirect means to view and subjectively evaluate gunner tracking performance. Future modification of the system could include a GACP type objective scoring device which could superimpose tracking scores on the CRT.

TMSVCS enables gunners to track any target of opportunity for evaluation purposes. There is no requirement for a conditioned IR target source. Also, the IP can observe what the gunner sees before and after a tracking sequence, to include the acquisition and identification phases.

Although present system design makes it nearly impossible to predict PH without rigorous analyses of video film, the future growth potential of the TMSVCS includes hit probability processing, and hit-or-miss indications at impact time. Computer generated imagery (CGI) could permit the projection of a simulated missile image into the unused eye of the binocular eyepiece of the TSU when training is being performed.

Some disadvantages of TMSVCS are its bulk and weight. Additionally, a system with a scoring device modification would cost more than GACP, but system potential could outweigh cost.

Testing of the two training devices, GACP and TMSVCS, was completed in February 1977 at Ft. Rucker. The U.S. Army Aviation Board, in cooperation with the Army Research Institute, was tasked to perform an operational test of the two devices to determine:

- The effectiveness of the two training devices as a means of enhancing first-round hit probability.
- The need for either the GACP or TMSVCS, or both devices, to teach TOW missile tracking at the Army Aviation Center.
- The feasibility of effectively teaching TOW missile firing sequence and/or tracking to aviators at the Aviation Center without firing missiles.

The evaluation lasted 6 months and was conducted in the institutional training environment of Ft. Rucker. For comparison purposes and to ascertain differences experienced in a tactical training environment, data amassed during Modern Army

Selected Systems Test, Evaluation and Review (MASSTER) operational test (OT) 131 and 185 was researched. During the two MASSTER tests, GACP and on-the-job training (OJT) (without devices) was performed and live missile firings were made to compare group performance.

During OT 131, both OJT and GACP training groups fired an equal number of missiles. Each group had the same number of misses. These results seem to indicate no increase in hit performance after training with a device. When the scores of the GACP trained gunners are inserted into today's charts, they suggest a much higher hit probability than resulted. Actual hit performance was a .875. Estimated performance using the chart now available was in the .98 to .99 range derived from average GACP scores taken after 110 simulated firings.

During the Aviation Center evaluation, GACP scores were taken during every 20-minute interval of training, or 15 practice simulated firings, whether trained by TMSVCS, GACP or OJT, as well as before training began and after training finished. The groups trained with TMSVCS and GACP reached their peak tracking performances in 1 to 1.5 hours of training. OJT trained gunners peaked at 2.5 hours of training without a device. Peak performance, measured by milliradian tracking error, when converted to PH results in scores that approach 1.0 PH. Therefore, OJT trained gunners, when given sufficient tracking practice, should have similar results when compared to GACP trained gunners during missile firing tests. Such was the case during the MASSTER study.

The hit performance of gunners on the MASSTER test was only .875 compared to the .96 hit performance of the group in the Aviation Center study. The performance variable appears attributable to the differences in institutional and tactical training listed in figure 5.

If student GACP scores of past graduates had been obtained in the tactical training environment as depicted in figure 5, the PH would likely be lower than the .99 it is today. It possibly would be equivalent to the .875 arrived at on the MASSTER test. Subjects tested at the Aviation Center were scored while tracking with GACP in a controlled institutional environment and received high PH chart estimates. They also fired missiles in a like environment and received a correspondingly high hit performance with the missiles.

The Aviation Center test did not find any improvement of first round hit probability when a device was used to train gunners. There was only one missile fired that didn't hit the target. That gunner had been trained by the OJT method.

Both TMSVCS and GACP cause a 40 percent reduction in required tracking training time when compared to the OJT method of training. Both devices provide the IP feedback which contributes to more efficient job performance.

When objective scoring devices are used, *missile firings can be eliminated.* Missile hit performance *is* representative of GACP score predictions.

It is not known which device, if any, might be procured for training purposes. If one is obtained modifications must be made to strengthen its usefulness as an effective training device.

Cobra/TOW gunners throughout the Army aviation community *are* highly proficient. Regular practice, tracking targets of opportunity with the TSU, will cause maintenance of tracking proficiency. MASSTER test results indicate a reduction in hit performance when "tactical combat conditions" are simulated, indicating a need to continue training and improve combat PH performance.

It could be quite an asset to have a scoring/training device that provides the means for assessing gunners' performances while they train and thus eliminate the need to fire live missiles to verify proficiency.

An important fact to remember is that training devices do not increase proficiency levels. Tracking practice is the key to improve proficiency. Training devices allow scoring of proficiency, eliminate missile firings and reduce training time.

Institutional Training

1. highly experienced IP/pilots
2. inexperienced gunners
3. unrestricted launch time
4. unobstructed LOS to target
5. a white painted target tank
6. stationary target tank
7. 2,700 meter range

Tactical Training

1. variable levels of pilot experience
2. variable levels of gunner experience
3. limited time to launch and remask
4. obstructions to vision (trees)
5. standard target tank
6. moving target
7. variable, changing ranges

Figure 5

Major Michael E. Herndon
Directorate for Technical Research and Applications
U.S. Army Agency for Aviation Safety USAAAVS

Why Inadvertent IMC?

Why have a 5C procedure or an inadvertent IMC recovery plan when AR 95-1 clearly outlines in table 4-1 the weather minima requirements for VFR operations?

DURING FY 76, Army mishap experience included several accidents labeled "unintentional flight into instrument meteorological conditions (IMC)" better known as inadvertent IMC. Because of these mishaps, the U.S. Army Agency for Aviation Safety (USAAAVS) developed an inadvertent IMC procedure called the 5Cs, designed to give aviators a fast-acting antidote to confusion and anxiety during the first 10 to 15 seconds after IMC penetration. Past inadvertent IMC mishaps show that it is during these first few seconds that the battle with inadvertent IMC is either won or

WHY INADVERTENT IMC?

A UH-1H pilot flew into marginal weather conditions and his helicopter struck trees and crashed. Seven of the nine crewmembers and passengers were killed, the other two were injured, and the aircraft was destroyed. This accident was caused by the crew trying to remain VFR in IMC.

Three Hueys took off for a night flight. Chalk 2, flying slightly higher than the lead or Chalk 3, entered IMC and made a Mayday call, stating he was spinning. Chalk 3 saw the lights on Chalk 2 as he came out of the clouds and struck the ground. Chalk 2 exploded on impact, killing all three crewmembers. This accident was caused by the pilot entering IMC inadvertently and losing control.

lost. If you can maintain aircraft control during this initial crucial period, your chances of surviving an inadvertent IMC experience are greatly enhanced.

The 5C procedure was intended for the aviator rather than as a means of recovering aircraft from the operating area. Why have a 5C procedure or an inadvertent IMC recovery plan when AR 95-1 clearly outlines in table 4-1 the weather minima requirements for VFR operations? Well, it would appear that strict enforcement of the regulation would prevent inadvertent entry into IMC. Certainly, we don't condone the violation of regulations or unauthorized entry into controlled airspace without proper clearance, but let's look at the problem realistically. During FY 76, more than half of all Army aviation fatalities were associated with inadvertent IMC accidents. This represents a serious and continuing problem for Army aviation. We cannot stand by idly and rationalize these losses by saying that regulation enforcement is a command function and is outside the purview of USAAAVS authority. The fact remains that the Army is losing lives and equipment through these accidents.

Let's briefly look at the 5Cs. The first and most important "C" is control because once you lose control all else becomes purely academic. Putting it in plain language, "If you don't have control of the aircraft, you don't have anything." Of course, we all know what control is, but under stress how do we exercise it? First, control must be consciously considered under normal conditions ... when in the flight lounge, while sitting around the briefing room, or while flying straight and level on a nice clear day. You must convince yourself that should you ever enter IMC and lose ground reference your only alternative is to immediately transition to instrument flight. If you fail to make this transition, you're in serious trouble because when ground reference is lost there is no time to regain visual contact. The old "look over your shoulder" for the visual conditions that you just left will merely set the stage for a good case of vertigo and result in loss of control.

The *only option available* is an immediate transition to instrument flight. Once you make this transition, control is established by cross-checking the flight instruments – first, the attitude indicator to ensure the aircraft is level; next, the heading indicator to ensure that the selected heading is being maintained; and finally, the airspeed indicator to ensure that forward flight is established and airspeed is stabilized. Based on the operating altitude, a climb may be established, if required.

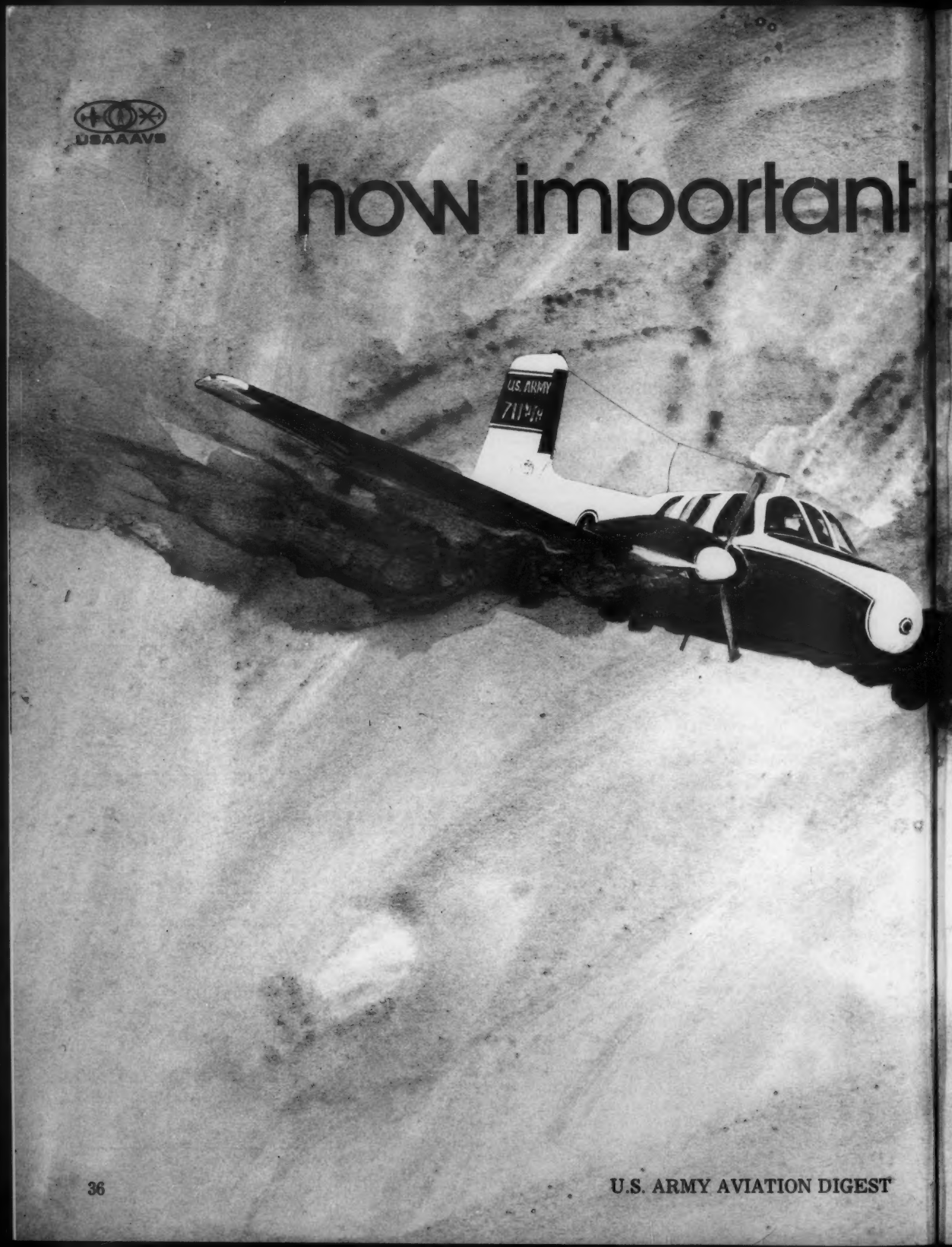
The four subsequent Cs – coordination, course, clearance and call – depend on the successful accomplishment of the first C – aircraft control. Practice of the 5C procedures under visual meteorological conditions will provide for a higher level of confidence in your ability to control the aircraft in actual IMC.

Inadvertent IMC is no longer just a topic for academic discussion. Whether or not there is really such a thing as "inadvertent" IMC flight is not debatable. IMC accidents are real; they continue to happen. Commanders and aviators who fail to recognize and deal with this problem pose a threat to Army aviation.

Read an account of a recent Chinook IMC accident in "Follow the Leader" on page 39

COMING SOON

a new safety training film titled "The 5C Recipe for Inadvertent Soup" will be available through your audiovisual support centers soon. Release will be announced in FLIGHTFAX.


USAAAVS
how important
U.S. ARMY

is the right symbol?

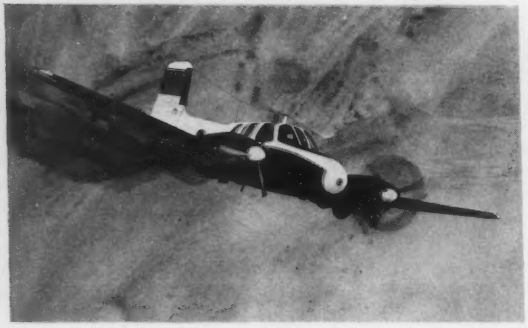
NO FAULTS suspected as a flight safety factor will be considered deferred maintenance. Since the dividing line between a red diagonal and a red X is often indistinct, the maintenance officer must exercise caution. He must ground the aircraft if there is a reasonable doubt of flight safety. This doubt must include the inability to obtain advice promptly from a higher category of maintenance. Any fault that could become dangerous by continued use will be considered a red X condition." So states FM 44-41, par. 3-16d, page 3-11.

Just how important is the right symbol? Recently, use of the wrong symbol resulted in the loss of lives and the destruction of an aircraft.

The aircraft involved had a long history of engine problems, including vibration, surging, backfiring and momentarily "cutting out" in flight. One engine had been replaced because of materiel failure and all six cylinders on the other engine had been changed. The trouble was diagnosed as faulty carburetion. When carburetors were replaced from those in the supply system, the problem subsided for a time, only to rise again. Carburetors were then overhauled and reinstalled on the engines; but the problem persisted. On one occasion, the left engine surged and vibrated excessively when carburetor heat was applied during climb between 6,000 and 8,000 feet. Swapping carburetors between the two engines transferred the problem to the No. 2 engine, confirming the diagnosis as one associated with defective carburetors.

Although this type of situation continued over a period of several months, the aircraft was kept on a flyable status by assigning a red diagonal symbol to the pilot's entry in the DA Form 2408-13 instead of a

HOW IMPORTANT IS THE RIGHT SYMBOL?



red X. Finally, as might have been predicted, the engine failed in flight, slinging a counterweight through the housing and causing a fire. The pilot immediately attempted an emergency landing, but he had no time to complete it. The intense heat weakened the wing structure supporting the engine to the point that the engine separated from the aircraft, causing total loss of aircraft control.

The question now arises as to what more a properly functioning carburetor could have done other than provide proper vibration-free operation of the engine. Even if the aircraft had been placed on a red X status, a test flight following carburetor replacement would have cleared the symbol and released the aircraft for flight. Right? Well, if that represents our reasoning, we had better go back to our books for a maintenance refresher course before we permit another accident from similar causes.

While the defective component was a carburetor, it was not failure of the carburetor but materiel failure of the engine that caused the fire. This materiel failure most probably resulted from detuning that occurred during those periods of excessive engine vibration, surging, cutting out, and severe backfiring. And while considerable effort was expended in trying to eliminate the induction problems, apparently little or no thought was given to the condition of the engine. Yet, two of the most common causes of engine failure are overboosting and detuning. Either can produce initial damage that, left uncorrected, can lead to total destruction of the engine. And both can readily occur – sometimes without our realizing it.

For example, the maximum permissible manifold pressure during takeoff in a U-8F is 48 inches Hg. *But* that is the maximum at *sea level*. At 5,000 feet, manifold pressure is limited to 46.1 inches Hg. Further, should the maximum permissible manifold pressure for any given altitude be exceeded by *any amount for more than 15 seconds, a mandatory engine change is required*. What happens when we take off from a field elevation of 800 feet? Or 1,200 feet? Or 1,800 feet? Do we always ensure that we do not exceed the maximum permissible manifold pressure for the particular altitude? Do we even know what that maximum limit is?

Our failure to remain aware of these limitations can result in our exceeding them for more than 15 seconds during takeoff. When this happens without our realizing it, not only are the engines not replaced, they are not even inspected or written up. Consequently, weeks, or maybe months, later an engine suddenly "lets go" and some unwary pilot finds himself with a pack full of trouble.

The problem concerning engine detuning is equally serious. Whether it occurs from improper operating techniques in violation of outlined procedures or from some materiel failure, the results are the same. In effect, the propeller is allowed to drive the engine, overstressing it. Severe or continued detuning will ultimately destroy the engine. The effect of surging, backfiring, and momentary "cutting out" of the engine is somewhat similar to that of rapidly retarding and advancing the throttle. And correcting the cause of the symptoms does nothing to alleviate the damage done to the engine. Sooner or later, if continued in operation, the engine is almost certain to fail.

The solution encompasses three major areas: knowledge of our equipment, its capabilities and limitations; use of the proper symbol to denote aircraft status following a specific writeup; and correct maintenance action to eliminate the problem as well as the symptoms, and ensure safe continued use of the equipment.

How important is the right symbol? Followed by proper corrective maintenance, it is one of the best forms of insurance available. And should we ever find ourselves becoming complacent, we might do well to recall the final transmission of the pilot to the control tower operator:

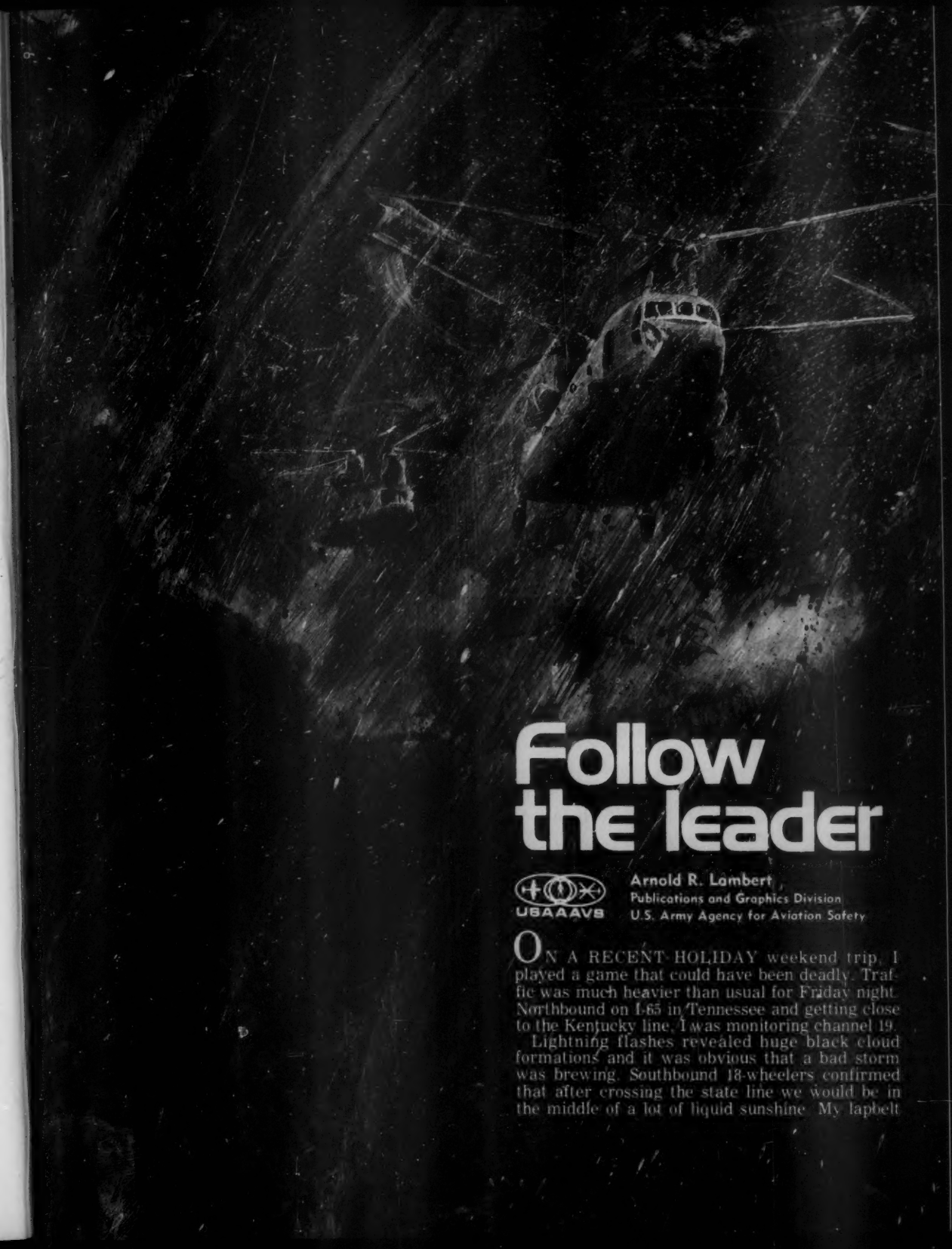
"... We have an engine on fire and we'll expedite our descent.

"We're in emergency descent – uncontrollable.

"We're going to crash right here pretty soon.

"This is it!"

Eight seconds later, it was all over.



Follow the leader

USAAAVS

Arnold R. Lambert
Publications and Graphics Division
U.S. Army Agency for Aviation Safety

ON A RECENT HOLIDAY weekend trip, I played a game that could have been deadly. Traffic was much heavier than usual for Friday night. Northbound on I-65 in Tennessee and getting close to the Kentucky line, I was monitoring channel 19.

Lightning flashes revealed huge black cloud formations and it was obvious that a bad storm was brewing. Southbound 18-wheelers confirmed that after crossing the state line we would be in the middle of a lot of liquid sunshine. My lapbelt

was fastened and the windshield wipers going when I crossed into the Bluegrass State. Then the clouds really opened up.

The rest areas were filling fast with motorists pulling in to wait for the storm to pass. Two 18-wheelers were jawing with each other about whether to stop or continue. One of them called himself "Gabby"; the other was "Leadfoot." It didn't take long for me to decide that both were aptly named. They agreed they couldn't make any money parked and decided to keep moving. That was when I decided to play follow-the-leader. I keyed my mike and called—"Breaker one-nine." The reply came from Gabby and I told him I wanted to tag along through the storm.

The storm got worse and I fastened my shoulder belt and turned the wipers on high. Suddenly Gabby wasn't so gabby because he had his hands full just trying to see where he was going. At times, all I could see were blurry red lights in front of me because of the hard rain and the vapor caused by the truck tires on the wet pavement.

Gabby was in the lead and I was bringing up the rear. We were not speeding but we were moving too fast for the weather conditions. Leadfoot signaled and moved into the left lane. I followed. We went around Gabby and this put me with about 45,000 pounds in front of me and about the same behind me. The thought of this caused more than a little discomfort. My thoughts were interrupted by a flash of lightning, followed by a flash of brake lights and a simultaneous swerve to the left. I followed suit and started skidding. I did a complete 360 and came within inches of hitting the truck in front of me and an overturned car. I could almost feel myself being crushed between 90,000 pounds of steel but fortunately we all got stopped.

The car had apparently skidded on the wet pavement and overturned. It was partially blocking the right lane. The driver was not hurt and helped the trucker set up warning flares. Leadfoot said the only thing that kept him from hitting the car was the bright flash of lightning.

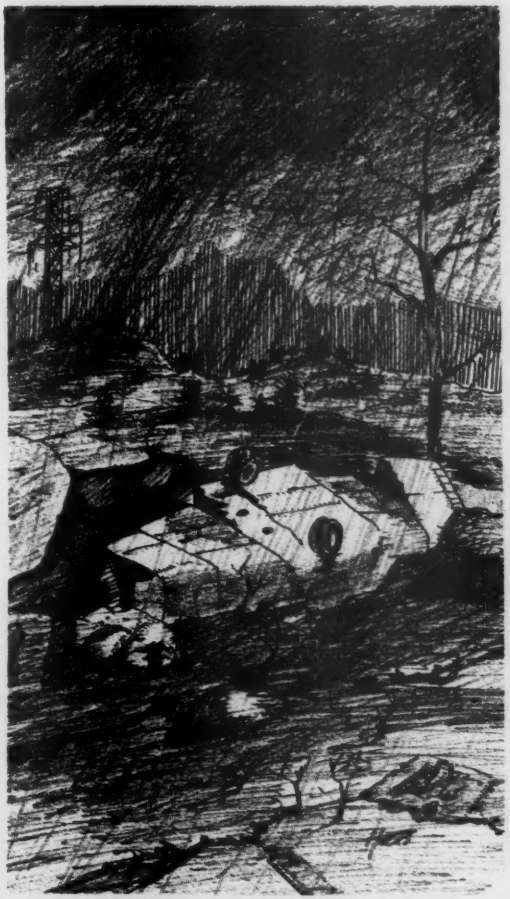
There was nothing I could do to help so I drove to the nearest rest area. I parked and sat there shaking. Thinking back over the last few minutes, I was reminded of how closely my near-miss paralleled a recent Chinook accident I had just reviewed. Their trouble also started with bad weather.

A flight of three Chinooks was in mountainous terrain. All of them had flown the area before. Five minutes into the flight, the pilot of Chalk 2 could see that the weather was not as forecast and was deteriorating rapidly. Chalk 1 reported they were reducing airspeed due to limited visibility. By this time, the entire flight was down in the valleys trying to maintain ground references. The hilltops were obscured and visibility was reduced by rain and fog.

Ten minutes into the flight, airspeed was reduced to 40 to 60 knots by Chalk 1 and the flight was in a loose trail with a separation of four or five rotor discs. At this point, the crews were no longer navigating by a map of the terrain and were attempting to work their way east to a highway. Chalk 1 said he was IFR and climbing, and then established contact with approach control and returned to the airfield.

Chalk 3 was at a high hover, approximately 150 feet. The pilot of Chalk 3 still had sight of one aircraft which he thought was Chalk 2. He watched the aircraft make a left turn, a right turn, and then disappear into the weather. While still at a high hover, the Chalk 3 pilot started a pedal turn. During the turn, he saw an orange flash through the fog. Because of the reduced visibility he had no reference as to distance or exact direction. Fearing that the flash may have been one of the

the accident was caused by the pilot attempting to maintain ground references and continue the mission by low-level flight under IMC...



other aircraft, Chalk 3 tried to hover further into the valley but was unable to because of the reduced visibility. Communication was established with the air mission commander (AMC) and Chalk 3 was told to terminate the mission.

It was later learned that Chalk 2 had flown into a set of six high-voltage powerlines, causing it to break up and crash. There were no survivors.

After reviewing all the information they had gathered, the accident investigation board figured that the pilot of Chalk 2 followed the lead aircraft into the valley and tried to continue using ground references after the lead aircraft reported he was going IFR and climbing out. Working his way near the ridge of the mountain, the pilot saw what appeared to be improved weather conditions on the other side. Climbing to clear the ridge line, he did not see the powerlines due to the limited visibility.

The board concluded that the accident was caused by the pilot attempting to maintain ground references and continue the mission by low-level flight under IMC, violating published VFR minimums. Also, the AMC did not designate a flight leader for the mission and the pilot of Chalk 1 led the flight into IMC at low-level altitudes in mountainous terrain.

When encountered, the unforecast weather conditions were not discussed between members of the flight in regards to continuing or aborting the mission.

I was startled out of my thoughts by the sound of engines starting. The storm was over and people were getting on their way again. I got back on the road and vowed never to play follow-the-leader again, especially through a storm.

See page 33 for the 5C procedure you need to know for inadvertent IMC

OH-58 pilots...

Want to know how you can lose tail rotor control without exceeding a single aircraft limitation stipulated in the -10, and without having any mechanical problems or materiel failures? Then read . . .

HOW TO CRASH-

BY THE BOOK

NOT TOO MANY years ago – before the advent of the recovery room – the expression "The operation was a success...but the patient died," was common, and unfortunately, true. All too often the surgeon's best efforts were negated by some complication that developed while the patient was left unattended. Today, we could properly coin a somewhat similar saying in Army aviation, and it might be worded something like this: "The flight was planned and conducted by the book...but the aircraft crashed."

Here, again, the cause can be properly attributed to some form of inattention; yet this type of situation is not an isolated one. In recent months, several OH-58 pilots were involved in remarkably similar accidents in which loss of tail rotor control precipitated each mishap. Further, in each instance, investigators found no evidence of maintenance error or materiel failure. Nor did they find any single aircraft limitation such as gross weight, CG, altitude, airspeed, etc., had been exceeded. Technically speaking, each flight had been properly planned and conducted in accordance with correct procedures. Nevertheless, in each instance, the tail rotor failed to respond to pedal input, and the resulting loss of control led to an accident.

Let's look at one of these mishaps through the eyes of the pilot. Here is what he had to say: "I changed my frequency (FM) to that of the unit that I was supporting and turned around to ensure that my passengers were properly strapped in, doors secure and belts inside the aircraft. I visually ensured this and was also given a thumbs-up from the back seat personnel.

"At approximately 1030 I performed my pretakeoff check. All instruments were normal, hover was normal, and I made my takeoff southwest into the wind. I was given directions to proceed southerly to a ground troop objective area. The object of the mission was to make radio contact, spot and observe the progress of some ground troops.

"I proceeded southerly...and made a left-hand turn over the objective area. It was one complete 360-degree orbit plus 180 degrees, rolling out on a northerly heading. I traveled several thousand meters north and made a right-hand turn...

"I traveled southerly for approximately 1,000 meters and entered a right-hand turn to a northerly direction. I traveled approximately 1,000 meters northerly and initiated a right-hand turn to a southerly direction. The aircraft fuselage continued to turn right. I applied left cyclic and removed right pedal input in order to straighten the aircraft out on a southerly heading. It was at this time that the aircraft first failed to respond to control input. As I entered the turn, all instruments were normal...and airspeed was approximately 50 knots. As I tried to pull out of the turn, the nose of the aircraft continued right and the aircraft was crabbing badly and continued to turn right. It would not respond to left pedal pressure. As it continued to turn, I could feel the tail lift up as it passed through a southerly direction (downwind)...

"Sometime during this period, I saw the airspeed at 40 knots. The aircraft continued to rotate to the right with increasing velocity, going from a somewhat elliptical pattern into a pattern of the fuselage rotating around the mast. The rotation was violent and completely uncontrollable, and gave the feeling the aircraft would come apart.

"During this time, the aircraft was picking up an increased rate of descent. During one of the rotations, when it became apparent that recovery would not be possible, I split the needles and reduced collective to full down. The aircraft continued to rotate at least 270 degrees to the right. I was unable to adjust the aircraft attitude so as to choose the point of landing (impact). I realized I would hit the trees. I leveled the aircraft and, just above the trees, I applied all available collective pitch to slow my rate of descent, and made a Mayday call.

"As I hit the trees, the nose of the aircraft pitched down as the tail made initial contact...The aircraft came to rest on the lower chin bubble portion of the fuselage, with the tail in the air..."

Now, for a more complete picture, let's fill in the gaps with information from the accident report.

To begin with, the pilot was to have picked up only one passenger before conducting the reconnaissance flight. However, a last-minute change resulted in three passengers boarding the aircraft. This increased the gross weight of the aircraft to more than 2,600 pounds.

When the aircraft arrived over the area to be reconned, the pilot flew a racetrack pattern approximately 1,500 meters long and 400 meters wide at an altitude that varied from 150 feet to 250 feet agl and at an indicated airspeed that fluctuated from 40 to 70 knots. The density altitude was approximately 3,100 feet. In making his turns, the angle of bank was determined to have approached 30 degrees.

While in a right downwind turn, the pilot noted loss of tail rotor control, and the aircraft continued to turn right in a nose-low attitude. The pilot applied left pedal and left cyclic, but the aircraft did not respond to control input. Instead, it began to spin in a clockwise direction, remaining in a nose-low attitude as it continued to descend at a moderate rate.

When it became evident that he could not regain control of the aircraft, the pilot entered autorotation while over a wooded area, then pulled all available pitch to cushion the aircraft and slow descent. The aircraft struck trees while still spinning to the right. On impact with the trees, the clockwise rotation stopped. The tail boom then hit a tree limb, causing the nose to pitch down steeply. The aircraft fell about 15 feet, struck the ground, and came to rest in a nose-low position, with the tail boom in the trees at about a 45-degree angle. The pilot and passengers evacuated the aircraft, with minor abrasions. There was no fire.

Additional pertinent information provided by the accident report shows the pilot was highly qualified and current, and had logged more than 3,000 hours of flight time. He was rested, and in excellent condition both physically and emotionally. Similarly, the aircraft was in excellent mechanical shape, and no maintenance problems or materiel failure contributed to this mishap. As a matter of fact, accident investigators were in total agreement that "*All* aspects of the flight were found to be within limitations as prescribed by the operators manual, with the exception of height/velocity (dead man's curve) for safe autorotation." So the question remains: What caused loss of tail rotor control in this as well as in other similar mishaps?

For the answer, let's revert to some basic fundamentals, keeping the following facts in mind:

- The pilot was fully qualified, and was in peak physical and mental condition for the mission.
- No mechanical or materiel problems contributed to loss of control.
- Low airspeed and altitude above ground level prevented a successful autorotation, but both were within the capabilities of the aircraft.
- Density altitude was high but not excessive.
- Aircraft gross weight was high but not excessive.
- Although the turning radius was short, the resulting steep angle of bank did not exceed the aircraft's capability.

Now, let's inject some suppositions in a hypothetical situation by considering a pilot orbiting his aircraft to the right at low altitude, with his attention focused on some particular object on the ground. Should he fail to fly his aircraft by attitude, and instead, fly by apparent ground speed, he may momentarily forget about the wind factor. Then, when he is headed downwind, his indicated airspeed may be drastically reduced. In fact, if the wind were strong enough, he could conceivably be flying backwards with respect to the wind flow across his aircraft.

As the aircraft continues the turn, it will tend to weathervane on encountering a right quartering tailwind. Should this sudden action take the pilot by surprise, he may fail to apply left pedal until after the aircraft has completed a 270-degree turn. The tail rotor could then readily stall if he should jam full left pedal. This would render the tail rotor system totally ineffective, allowing the aircraft to continue to rotate because of engine torque.

When the nose of the aircraft swings through the original heading, the tail rotor will tend to come out of the stall. However, as the aircraft continues its turn into the wind and past it, the rotor could stall again. This cycle could repeat itself, misleading the pilot into believing the tail rotor has failed. Consequently, he may enter an autorotation. Since he is operating at a low altitude, the chances of his "bending" the aircraft are almost a certainty.

Going a step further, let's examine the events that take place when wind strikes a rotating air-

craft from the left, flowing across the tail rotor. Let's suppose the velocity of the wind is 25 knots and the helicopter is rotating at 1 rpm, the equivalent of 6 degrees per second. Assuming the tail rotor blades to be in a neutral position, the angle of attack will be 3.5 degrees. Since the angle of attack of the blades can be varied approximately 17.5 degrees either side of neutral, if full left pedal is suddenly applied, the angle of attack will become 21 degrees (and these computations are figured for the blade tips). This means the entire tail rotor system will be stalled since the inner portions of the blades will stall first.

In reviewing this hypothetical situation, we can pick out several important factors that collectively resulted in a premature autorotation and a mishap.

1. Operation at a low altitude.
2. Operation at low airspeed.
3. Failure to fly the aircraft by attitude.
4. Failure to consider wind direction and velocity which resulted in failure to realize why the aircraft suddenly wanted to turn around.
5. The sudden jamming of left pedal which led to a tail rotor stall.
6. Failure to realize the tail rotor had stalled and not failed.

Had any one or two of these conditions not been present, the mishap might have been averted. But instead of eliminating any of these factors, let's include two additional ones: a heavy load for the existing density altitude and a steep bank angle during turns.

If our hypothetical aircraft was already near its maximum permissible gross weight for the prevailing density altitude, flight at low airspeed would necessitate near maximum power. Banking the aircraft would then create a demand for even more power if airspeed and altitude were to remain constant. Yet, the engine was already producing nearly full power. The result becomes obvious. Under these conditions, something has to give – loss of altitude, airspeed, and probable loss of tail rotor control.

Relating this information to the numerous OH-58 mishaps that have resulted from loss of tail rotor control, we can readily see that even though no single aircraft limitation may be exceeded, control problems and mishaps can occur under certain conditions of flight.

Prevention of mishaps from these causes depends in great measure upon the pilot and his supervisor. For example, proper supervision during briefing can make certain the pilot is aware of the conditions he can expect to encounter during an assigned mission so that he may be forearmed. In addition, supervision can ensure no greater demands are placed on man and machine than those actually required to complete a given mission. If low-level flight is not essential to accomplish the objective, then let's assign the pilot an altitude that will keep him within the height/velocity envelope. Similarly, if it isn't necessary for the pilot to confine his aircraft within a narrow parameter and to operate at a slow airspeed, then let's not place these restrictions on him. Instead, let's assign him an area that will permit a higher airspeed and a wider turning radius.

The pilot, in turn, needs to remain constantly aware of the prevailing conditions during any given phase of flight. He should fly the aircraft by attitude rather than by apparent ground speed, apply control inputs smoothly, and be aware of the approximate wind velocity and its direction. Should he then find himself with some control problem, he will be more likely to correctly diagnose the cause and take proper emergency measures.

Let's not permit ourselves to ever feel so secure in our knowledge and ability to handle our aircraft that we inadvertently become involved in mishaps – even though we may, supposedly, be operating by the book!

For more information on this subject, contact Mr. Pat Hollifield, Directorate for Plans, Operations & Education, USAAAVS, AUTOVON 558-2091/4806, commercial (205) 255-2091/4806.

USAAAVS
Sergeant Major Wesley E. Toon
U.S. Army Agency for Aviation Safety

Where do you look for an accident prevention NCO?

WHEN YOUR TV conks out, you may get it back in operation yourself by simply replacing a tube. But anything beyond that requires special skill. A good handyman may be capable of recharging his air conditioner with a few cans of coolant but beyond that he too will probably reach for the yellow pages and call for the specially trained.

With all the unique and complicated equipment used by the Army these days, many specialized skills are required. And sometimes it becomes a problem identifying and keeping track of personnel having specialized training. Obviously the commander is not going to find them in the yellow pages, so what is the answer?

A 2-week Aviation Accident Prevention Management Course (AAPMC) has been conducted at the U. S. Army Agency for Aviation Safety (USAAAVS) on a regularly scheduled basis for several years. Initially, files were maintained at USAAAVS on personnel who had attended the course and unit commanders knew the individuals, so there was no problem. The problem of keeping up with and identifying these individuals started when they were transferred to other organizations. The only way to locate the AAPMC graduates was by a records screen which was time consuming. It was common to find several of the specially skilled people in one company while a like unit across the street in the same battalion would not have any.

In 1974, the Enlisted Educational Division of USAAAVS tried to establish a system that could be used to readily identify the hundreds of personnel who had attended the AAPMC. After hours of reading regulations and numerous telephone

calls, a decision was made to apply for an Additional Skill Identifier (ASI). When approved, the ASI would:

- Permit commanders to identify TOE/TDA positions within their organization for AAPMC-trained personnel.
- Permit commanders to identify AAPMC graduates simply by checking the MOS.
- Permit commanders to requisition personnel using the ASI.
- Permit enlisted assignment managers in MILPERCEN to assign personnel based upon the ASI in the requisition.

Several months later, ASI A2 was established for enlisted personnel in MOSC 67F, 67G, 67H, 67N, 67U, 67V, 67W, 67X, 67Y, 67Z and 71P who had successfully completed the AAPMC after 17 July 1973. The effective date was 1 March 1976. Establishment of ASI A2, accomplished by close coordination between USAAAVS and MILPERCEN MOS Branch and Aviation Enlisted Assignment Branch, was publicized in FLIGHTFAX, ARMY AVIATION DIGEST, and by TWX. A change to AR 611-201 authorized the ASI and DA Circular 611-43 implemented the change. Enlisted Personnel Management System eliminated 67F and 67H from the list of MOSCs authorized the ASI but all others are current.

USAAAVS began awarding the ASI in March 1976. Personnel who had completed the course between 17 July 1973 and 1 March 1976 were encouraged to present their diplomas to their respective personnel activities to have records annotated and the ASI awarded.

So, some 18 months after work began the ASI was established and awarded and all is well. Right? WRONG! There is still one small problem. The supply exists but there is no demand. Personnel who have completed the AAPMC are easily identified by the ASI. No problem there. However, as of 1 April 1977 (13 months after the effective date), no requisitions with ASI A2 had appeared in the Enlisted Aviation Assignment Branch of MILPERCEN except for MOS 71P. The problem seems to be that very few units are submitting changes to their TOE/TDA to reflect the need for these specially trained people.

Procedures for submitting changes to TOE/TDA authorization documents can be found in ARs 310-49, 570-2 and 570-4. By changing the document to reflect those positions where ASI A2 holders are desired, requisitions can be submitted and filled when a vacancy exists.

Mishap data at USAAAVS indicates there is a need for these people and, at present, approximately 800 individuals on active duty either hold or are authorized the ASI. They should be assigned to positions where their training could be beneficial. They are not in the yellow pages but they are easy to find.

ATC action line

UNITED STATES ARMY AIR TRAFFIC CONTROL ACTIVITY

HOW CAN WE avoid sheer outright confusion in making wind shear reports?

It's the old story of ambiguous meanings of words – why you feel a full course in semantics should have prefaced your solo. The air traffic verbal experts are now advising that:

Various terms used to convey wind shear information have resulted in interpretations contrary to intended meaning. Pilot weather reports (PIREPs) of "negative wind shear," intended to describe loss of airspeed and lift, have been interpreted to mean no wind shear was encountered. Danger in use of "negative" to describe wind shear effect on aircraft is obvious and pilots are requested not to use this term for that purpose.

Recommended method for wind shear reporting is to state loss/gain of airspeed and altitude(s) at which it was encountered. Examples are: "Denver Tower, Cessna 1234 encountered wind shear, loss of 20 knots at 400 feet"; or, "Tulsa Tower, American 721 encountered wind shear on final, gained 25 knots between 600 and 400 feet followed by loss of 40 knots between 400 feet and surface." Pilots are encouraged to use this method of describing wind shear, and both pilots and controllers should question any report which may be confusing. Pilots who are not able to report wind shear in these specific terms are encouraged to make reports in terms of effect upon their aircraft. Controllers should be aware of importance of wind shear information and relay it in a timely manner including reporting aircraft type.

So the watchword is – watch your use of words to accent the positive!

Does the phrase "clear to taxi to runway" mean permission to cross intervening usable runway(s)?

Yes. Controllers are being realerted that the verbal instruction to pilots provide for permission to cross any intersecting runways to include the active runway if taxi routing intersects it.

Readers are encouraged to send questions to:

Director
USAATCA Aeronautical Services Office
Cameron Station, Alexandria, VA 22314

The first AH-1S HueyCobra (Production) is in use in the training program at the U.S. Army Aviation Center at Ft. Rucker, AL. The Cobra is designed and structured to perform the antiarmor attack helicopter role in a nap-of-the-earth (NOE) environment. It looks similar to earlier model Cobras except for the squared canopy which improves visibility for both seats. (U.S. Army Photo by SP4 Debbie Caskey)

Rescue By 101st Aviators

Rescuers of the civilian pilot are shown by their UH-1. The aviators are WO1 Thomas Potts (left), SGT Gerald Heitzman (kneeling) and CW2 Steven Robison (U.S. Army photo by SP4 Sharon Foley)

THREE 101ST Airborne Division (Air Assault) aviators broke their routine 8 July at Nashville (TN) Metro Airport with the daring rescue of a trapped pilot from the flaming wreckage of his plane.

Pilot CW2 Steven Robison, copilot WO1 Thomas Potts and crew-chief SGT Gerald Heitzman of the Screaming Eagle Division's 163rd Aviation Company, pulled semiconscious pilot William Wallace Locke of McMinnville, TN from his burning Cessna 421 moments before it was totally engulfed in flames.

The crew was waiting for the arrival of a general officer when a call came from the control tower that Mr. Locke's plane was losing power and had disappeared from the radar screens.

The tower controller asked the Army aviators if they could search the suspected crash site. The crewmembers dashed to their UH-1 Huey, cranked up and took off in the direction of the crash. They were guided toward the crash site by radar vectors from the control tower.

About a mile away from the wreck, they spotted a spiraling column of smoke. They closed in after a positive identification and landed at the crash site.

SGT Heitzman noticed movement in the cockpit and they began to search the burning plane for an entrance. WO Potts opened the only access, a cabin door on the left side of the aircraft, shouted into the smoke-filled cockpit and asked Locke if he was able to move to the cabin area.

The injured man crawled to within his reach. CW2 Robison assisted WO Potts in lifting the crash victim clear of the blazing wreckage. SGT Heitzman ran to the Huey and began administering first aid with the medical supplies from the Huey's first aid kits. CW2 Robison, meanwhile, called the Nashville tower to relay their situation.

Because of Mr. Locke's serious wounds, he was flown to Saint Thomas Hospital in Nashville. Upon returning to the airport, the crew refueled its aircraft and again awaited the arrival of the general.

TOW Cobra –

The School Solution - page 2

Gunner Training Devices - page 3